RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

EDITOR

Howard P. Doub, M.D.
Detroit, Michigan

Volume 61

July—December 1953

Owned and Published as its Official Journal by
THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

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Vol. 61 JULY, 1953 No. 1

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RADIOLOGY is entered as second class matter at Syracuse, New York, and Easton, Penna., under the Act of August 24, 1912, and accepted November 24, 1934. RADIOLOGY is published by the Radiological Society of North America as its official Journal. Subscription rate $10.00 per annum. Canadian postage, $1.00 additional. Foreign postage, $2.00 additional. Single copies $2.00 each. All correspondence relative to business matters connected with the Radiological Society of North America and RADIOLOGY, or remittance for non-member subscriptions, should be made payable to the Radiological Society of North America and should be addressed to the BUSINESS MANAGER, DONALD S. CHILDS, M.D., 713 E. GENESEE STREET, SYRACUSE 2, NEW YORK. In requesting change of address, both the old and the new address should be given.

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Walter B. Cannon

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Walter Bradford Cannon: 1871–1945[1]

GEORGE W. HOLMES, M.D.

Belfast, Me.

DR. JOSEPH C. BELL (*introducing Dr. Holmes*): *It occurred to our Program Committee this year that a lecture on some phase of the radiologic history of medicine would and should be of interest to all. I might say, in this connection, that personally I hope that this may become a regular feature of our Annual Meeting. The lecture that is to be given today commemorates the life of one who has greatly influenced the development of diagnostic radiology in America and in the world as well. It is doubly significant because it is to be delivered by one of America's greatest radiologists, a man who is well known to most of us, a teacher, scientist, and friend.*

I am greatly honored to present to you Doctor George W. Holmes, Emeritus Professor of Radiology of Harvard Medical School, now of Belfast, Me.

WHEN YOUR President honored me with the assignment to give this, the first historical lecture of the Radiological Society of North America, he suggested that the subject be Dr. Walter B. Cannon, for many years my teacher and friend. In the preparation of this paper, it was necessary to review at least the most important of Dr. Cannon's books and papers. While accomplishing this pleasant task I have acquired much valuable knowledge and have come to have an even deeper respect for this great scientist and teacher.

A biographical lecture such as this should honor the man or woman whose work is being presented and should, I think, point out as far as possible those traits of mind and character which made him great, in order that others may profit from his example. This I shall attempt to do.

Walter Bradford Cannon was born at Prairie du Chien, Wisconsin, Oct. 19, 1871; he died at his summer home in Franklin, N. H., Oct. 1, 1945. His forebears were early American pioneers. His mother, Sarah Wilma Denio, was a descendant of Jacques de Noyon, a French Canadian *coureur de bois*, who came to Deerfield, Mass., and there married Abigail Stebbins a few years before the French and Indian raiders descended on that village, burning the houses, killing forty-seven of the inhabitants, and taking captive the remainder. Among the latter were Jacques de Noyon and his family, who survived the long march to Montreal through the snow and cold of winter, probably because of de Noyon's knowledge of the Indians and the forest.

Dr. Cannon's father, Colbert Hanchett Cannon, descended from Samuel Carnahan, a Scotch-Irish immigrant from Ulster who arrived in Boston in the year 1718.

[1] Presented at the Thirty-eighth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 7–12, 1952.

The spelling of the name Carnahan was changed to Cannon. Like the Denios, the Cannons followed the pioneer trails slowly westward until their descendants met in a small town on the upper Mississippi River.

It is said that our frontiers today are in the field of science. If this is true, Dr. Cannon to a remarkable degree carried on the traditions of his forefathers.

He attended public primary and grammar schools in Milwaukee and St. Paul. Entering the St. Paul high school in the year 1888, he completed the four-year course in three years. In his book, *The Way of an Investigator*, he says: "I was older than most of my classmates, because my father, convinced that I was not paying proper attention to my studies in the grammar school, when I was fourteen had put me to work in a railroad office. There I remained for two years. The chief value of that experience was a heightened appreciation of the value of free time." Having had a somewhat similar experience in my own life with equally beneficial results, I sometimes wonder if this is not a better procedure, when an adolescent boy is disinclined to study, than to call in a tutor.

Dr. Cannon's family were ardent Congregationalists, and early in life he became a member of that church. During his high school years, however, he developed an interest in the writings of Huxley, Fiske, Clarke, and others, and became dissatisfied with the Calvinistic doctrine of his denomination. Gradually realizing that he no longer held views accepted by the members of the congregation and after a rather stormy period of discussion with his father and the clergy, he resigned from the church. Few boys in their 'teens have the independence of thought or the courage to take such action. Thus, early in life he displayed traits of character which were to play an important part in his future work.

The serious reading which Walter Cannon was doing at this time was a strong influence in his decision to obtain a college education. Because of his limited funds, the University of Minnesota seemed to be the logical choice. But a Harvard graduate whom he chanced to meet and his English teacher in the high school, who helped him to obtain a freshman scholarship, turned the scales. In the year 1892, with this scholarship and one hundred and eighty dollars from his father, he entered Harvard College. From that time on, through four years of college and four years at Medical School, he was on his own. In spite of the fact that a considerable portion of his time was expended on matters outside his studies, he graduated in 1896 from college, *summa cum laude*.

During his first year in the Medical School, Dr. Cannon received the degree of Master of Arts and in June 1900, that of Doctor of Medicine. From 1900 until his death in 1945, a period of nearly half a century, he was a member of the faculty of the Harvard Medical School. Following his graduation, he was appointed Instructor in Physiology. Two years later he was made Assistant Professor, and in 1906 he succeeded Henry P. Bowditch as George Higginson Professor of Physiology, a position which he held for thirty-six years.

His experience in research, however, began before he entered upon his medical studies, when he assisted Professor Charles Davenport at Harvard College with some experiments on phototaxis of minute organisms. In his first year in Medical School, at the suggestion of Dr. Bowditch, he undertook a study of the movements of substance through the esophagus by means of the recently discovered roentgen rays. This study, which was carried on in Dr. Bowditch's laboratory, was soon extended to include the entire gastrointestinal tract and led to the development of the opaque meal. This work occupied Dr. Cannon for several years and was the first of his many contributions to medical science. His first account of these studies was given at a meeting of the American Physiological Society in May 1897. During the year 1898 he published three papers on the movement of food in the esophagus and stomach. Two appeared in the *American Journal of Physiology* and one, presented

in part to the Boston Society of Medical Science, was later translated into French and published in Poitou's *Le médical*. It is worth noting that the young investigator did not confine himself to a single publication, a mistake often made by discoverers of new facts.

Cannon's first observations were on the passage of a metal button through the esophagus of a goose. But it soon occurred to him that a meal could be made to cast a similar shadow and also show the changing shape of the stomach or other parts of the alimentary canal through which it was passing if it was mixed with a substance opaque to the x-ray. He tells us that he tried out many of the insoluble salts of heavy metals including bismuth subnitrate, but he fails to mention barium. It was not until several years later that others discovered the superiority of the latter preparation for this type of examination in medical practice.

At about this time, Dr. Francis Williams of the Boston City Hospital was investigating the use of the roentgen ray in medical diagnosis and had already reported part of his epoch-making studies on the heart and lungs. Dr. Williams became interested in Cannon's work, and together in 1898 they examined the stomach of a child after it had been given a meal mixed with bismuth subnitrate. (The results of this and other similar examinations are described in Williams' *Roentgen Rays in Medicine and Surgery* first published in 1901 by Macmillan.) Impressed with the value of the method and the possibility of employing it in the diagnosis of diseases of the gastrointestinal tract, Williams began using it almost immediately in his clinic.

The greater part of Dr. Cannon's investigative work was done on cats. The animals were not anesthetized but were trained to lie quietly on the table during the fluoroscopic examination. In recording his observations, he noticed that all or nearly all movement of the stomach stopped at irregular intervals. This phenomenon interfered considerably with his work until he discovered that it occurred only when the animal was disturbed or frightened. For example, when a dog was brought into the laboratory all peristalsis in the cat's stomach ceased. That the same phenomenon occurs in man is now well known to every radiologist who has attempted to study the duodenal bulb in a badly frightened patient.

This observation led Dr. Cannon into his second great adventure, the study of the effect of hunger, fear, and rage on the body, especially on the adrenal and other ductless glands, as well as the relation of these emotions to the sympathetic nervous system. This research project was his major occupation during the thirty-six years in which he occupied the chair of Professor of Physiology at the Harvard Medical School. The only break in this long period of continuous investigation was during World War I, when he served with the Armed Forces overseas, first as Lieutenant, later as Captain, Major, and finally Lieutenant Colonel.

An important part of Dr. Cannon's work in the Army was his service as a member of the English Committee on Shock, formed by Professor W. M. Bayliss. In recognition of this service he was made Companion of the Bath, an English honor, and was awarded the Distinguished Service Medal in this country. During the years 1918–19, he published a book entitled *Traumatic Shock*, as well as twenty papers on the subject, a major contribution to this problem and one which has helped to establish its present successful management with the saving of many valuable lives.

The importance of Dr. Cannon's work was recognized during his lifetime and he received many honors. In addition to those already mentioned, he was the Wesley Carpenter Lecturer of the New York Academy of Medicine in 1923, the Croonian Lecturer of the Royal Society, London, and Linacre Lecturer, Cambridge University, in 1918. He was a member of the American Physiological Society, and its president in the years 1914–16, and a member or honorary member of twenty or more other scientific societies in this and foreign

countries. He was visiting professor at the Peking Union Medical School in 1935. There he observed the weakness of China's ancient civilization and became interested in her struggle for a better life. Later, he assisted the American Bureau of Medical Aid to China and the China Relief Organization. He received honorary doctorates from Yale University, Boston University, and the Universities of Liége, Strasbourg, and Paris, as well as from Harvard. He was a member of the American Association for the Advancement of Science and in 1939 its president.

Dr. Cannon was author or co-author of ten books and over two hundred scientific papers. Of all his publications, the book *The Way of an Investigator*, written during his last illness and published in 1945, the year of his death, will perhaps live the longest. As its title implies, this book deals with the problems which confront the investigator and teacher and contains the advice of a master on how to solve them. It should be read by all radiologists. The following extracts will give you some idea of the man and of his work.

"While no amount of learning will provide a man who lacks them, with those inborn qualities of imagination and enterprise which make for productive scholarship, it is clear that the experimental investigator should be a person of broad education. He should not only know the past of his own science—what has been achieved by others in the special field in which he is working, what his contemporaries are doing, and the varieties of methods that can be brought to bear in solving the problems he has set himself—but he should also be informed about other sciences. In addition, he should have some knowledge of foreign tongues, and should be able to write well in his own.

"One advantage presented to the investigator by the combination of research and teaching arises from the duty imposed upon him, as a teacher, of reviewing annually much or all of the field he cultivates.

"Years of experience have built up within me the conviction that education can be acquired only by earnest effort on the part of the students. This conviction implies that experience with laboratory experiments and conferences between the teacher and small groups of students in which there is free and informal discussion, instead of a one-way quiz, are much to be preferred to an elaborate and prolonged series of lectures.

"Desire to give due credit to earlier investigators in the field which he is extending often presents the scientific writer with a dilemma. Descriptions of previous studies consume print and paper and human labor, and crowd library shelves. On the other hand, credit should be assigned where it is warranted, for otherwise the reader may not know the antecedents of the immediate enterprise and the workers who have contributed to it, and may therefore fail to understand the relative importance of the discoveries being reported. Not infrequently this dilemma can be solved by references to summarizing articles in previous publications to which, in all fairness, the attention of the reader can be directed. In such circumstances it is not necessary to introduce the account of a research by an elaborate historical preamble; citations may be limited to those most directly pertinent.

"By carefully avoiding untested assumptions, then, by making sure that an experiment is carried through to the end, by invariably insisting on adequate controls, by meticulously examining apparatus for possible defects, by scrupulously attending to a close fit of conclusions to observed facts, the investigator may hope to avoid errors. And if, in reporting methods and results, pertinent details are not neglected and the paper is given a title that properly defines the contents, he may feel that he has done his best to tell the truth.

"In listing the traits which have seemed to me important for a career of investigation—curiosity, imaginative insight, critical judgment, thorough honesty, a retentive memory, patience, good health, generosity and the rest—I have not attempted to weigh their relative values. Anyhow, that would be difficult. A beginner, who seriously plans a life of productive scholarship, should not be disheartened if he thinks his qualifications do not meet requirements. Training and practice may not lead to perfection, but they will surely compensate for early inadequacy."

I have quoted perhaps more extensively from this work of Dr. Cannon's than would seem advisable in a paper as short as this, but his own words present the type of man he was much better than any of mine. In fact, I found it difficult not to include other passages of equal wisdom.

Nothing in Dr. Cannon's life did him greater credit than the way in which he endured suffering and the certainty of a fatal outcome in his last illness. I was privileged to direct some of the therapeutic procedures that for a time relieved the intense itching which was a most distressing symptom of his disease. I never heard him complain and, although he was not a religious man in the common acceptance of

the term, he showed no fear. He continued his work to the extent of his physical ability until the end. His last writings were dictated to his wife when he was unable to leave his bed.

Prior to the summer of 1931, Dr. Cannon had suffered no serious illness. At that time, at the age of fifty-nine, fiery red, itching, papular lesions appeared on the skin of his back, chest, thighs, and elbows. During the summer of 1932 he led an active outdoor life and his condition was somewhat improved, but attacks of pruritus continued to occur and the skin remained red, with gray patches on the forearms. In the fall of 1932, biopsy of these lesions established a diagnosis of mycosis fungoides.

During 1938 there was a progressive rise in the white count of the blood cells. This increase in white cells represents a leukemic phase of mycosis fungoides and emphasizes the close relationship of the disease to the lymphomas and leukemias. An unusual manifestation of mycosis fungoides appeared in 1942, consisting in earache, loss of the sense of taste for sweets, and finally development of a paralysis of the right side of the face. There is little doubt that this episode was further evidence of the lymphomatous process, as under treatment with x-rays it improved rapidly and finally disappeared. The progress of the disease was slow but relentless, death occurring fourteen years after the appearance of the first symptoms.

It is of interest to speculate on the relation, if any, of Dr. Cannon's exposure to roentgen rays to his final illness. He began his experimental work in fluoroscopy in 1897. At first there was no protection from the rays, but later the tube was shielded to some extent. That he received considerable direct exposure is shown by the fact that extensive keratotic lesions developed on his hands and forearms. One of these lesions on the left wrist ulcerated and was excised; it proved to be a slowly growing epidermoid carcinoma. In a summary, his physician, Dr. Joseph Aub, stated: "The etiological agents can only be postulated, but a leading predisposing factor may have been the considerable exposure to x-ray radiation suffered by Dr. Cannon in early investigative work on the gastrointestinal tract."

We, as radiologists, owe a special debt to Walter Cannon. The radiological diagnosis of diseases of the gastrointestinal tract, based on his early work, has been an important factor in the maintenance of radiology as a specialty.

What are the outstanding characteristics of this great teacher which we, his disciples, should remember and strive to emulate? He was a tireless worker. Someone has said that the great advances are not made by the eight-hour-a-day man. He took time to prepare himself for his chosen work, and in this preparation he included a mastery of the English language. He associated himself with advanced thinkers of his profession, and as a teacher he helped develop an ever increasing number of eager young disciples. He did not allow himself to be tempted by offers of financial gain, or change in the general character of his work, but continued in the same laboratory for nearly half a century. If we add to these things, over which one has control, an exceptionally brilliant mind, we can in some measure understand the achievements of Walter Cannon.

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Belfast, Me.

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The Supraclavicular Shadows in Chest Film Interpretation[1]

COLONEL HAROLD I. AMORY, M.C., U.S.A.[2], and MAJOR PAUL E. SIEBER, M.C., U.S.A.[3]

THE WELL KNOWN supraclavicular shadows present on most postero-anterior films of the chest are valuable aids to diagnosis, though their use has not been previously described. These shadows, as well as the sternomastoid shadows, are pointed out only as normal features, and the student is cautioned against confusing them with pathological lesions (Fig. 1).

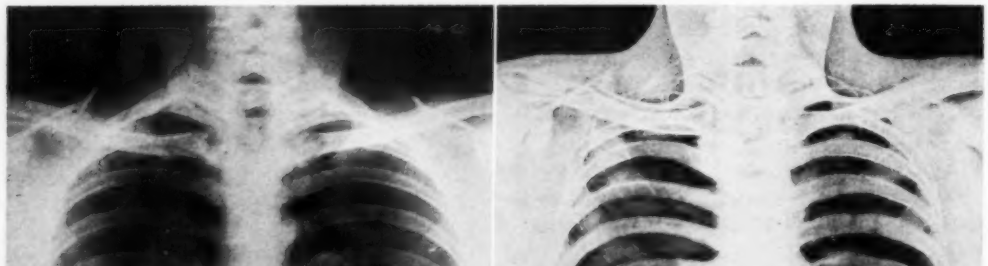

Fig. 1. Normal supraclavicular shadows.

The frequency of masses in the neck resulting from lymphomata, tuberculosis, thyroid, salivary gland, laryngeal and superior sulcus tumors, and metastatic involvement from carcinoma of the breast and testes is well known. Any of these diseases may produce masses that partially or completely obliterate the supraclavicular fossae, either as a result of metastasis from a distant primary lesion or by direct extension (Fig. 2).

In the past, masses in the neck have been recognized chiefly by a bulging silhouette, displaced muscle shadows, displacement of the trachea and esophagus, erosion or invasion of bone, and by the presence of calcific deposits. This report stresses the supraclavicular shadows as an additional aid in the detection of cervical masses and certain other abnormalities which involve the base of the neck.

On the chest film of a white woman aged sixty, under study for possible recurrence of carcinoma of the breast, it was noted that the left supraclavicular shadow was absent, while the right was normal. Investigation revealed a 3.5-cm. firm, nodular, roughly spherical mass in the left supraclavicular fossa which proved histologically to be a metastasis. It was obvious from the film that there had been a right radical mas-

[1] Accepted for publication in July 1952.
[2] Chief, Radiological Service, Walter Reed Army Hospital, Washington, D. C.
[3] Radiological Service, Walter Reed Army Hospital, Washington, D. C.

tectomy, but no evidence of recurrent disease other than absence of the left supraclavicular shadow was present.

During the few months since this sign was first observed, 11 additional cases in which abnormal supraclavicular shadows were present have been found (Table I).

Case 2 is typical and will serve to illustrate the diagnostic significance of the supraclavicular shadows. On March 6, 1952, a postero-anterior film of the chest of a 35-year-old white woman revealed nothing abnormal except absence of the right supraclavicular shadow. Investigation confirmed the presence of supraclavicular masses on the right and disclosed the fact that the patient was receiving radiation therapy to the right supraclavicular region for Hodgkin's disease. A review of earlier films showed that in September 1950 there had been extensive mediastinal masses which completely disappeared after radiation therapy. The right supraclavicular shadow was found to be absent on the old films (Fig. 3), but its absence had not been detected. Chest films following completion of the recent course of irradiation showed that the supraclavicular shadow had reappeared. It was interesting to note that the shadow was now thicker than the normal one on the opposite side (Fig. 4). This was interpreted as due to a thickening of the skin and subcutaneous tissues over the right clavicle as a result of reaction to the radiation. Inspection of the therapy portals disclosed a first-degree skin reaction.

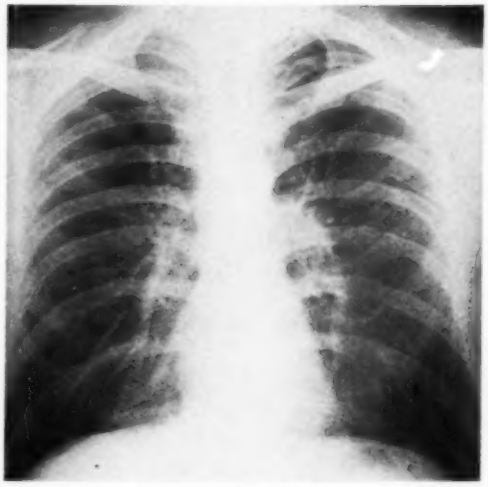

Fig. 2. Case 8. Obliteration of right supraclavicular shadow by Hodgkin's disease.

A comprehensive review of the literature and many personal inquiries failed to reveal that any practical use had been made of the supraclavicular shadows from the standpoint of diagnosis. In fact, even anatomical information concerning them is sparse. Shanks and Kerley in their discussion of soft tissues of the chest wall, describe breast, pectoral, and sternomastoid muscle

TABLE I: TWELVE CASES IN WHICH ABSENCE OF THE SUPRACLAVICULAR SHADOW WAS OF DIAGNOSTIC SIGNIFICANCE

Case	Age (yr.)	Sex	Absent Shadow	Disease	Cause of Obliteration of Shadow
1	60	F	Left	Carcinoma, right breast	Metastasis to left supraclavicular lymph nodes
2	35	F	Left	Hodgkin's disease	Involvement of left supraclavicular lymph nodes
3	20	F	Bilateral	Hodgkin's disease	Extensive involvement of cervical and supraclavicular lymph nodes
4	80	F	Right	Carcinoma, right breast	Metastasis to right supraclavicular lymph nodes
5	58	M	Left	Oat-cell carcinoma, right lung	Fibrosis and contraction of skin and subcutaneous tissues following radiation therapy
6	56	M	Left	Carcinoma, left parotid gland	Metastasis to left supraclavicular region
7	19	M	Bilateral	Very large mediastinal mass	Edema of neck, vena caval syndrome
8	35	M	Right	Hodgkin's disease	Supraclavicular lymph node involvement
9	22	F	Right	Tuberculous adenitis	Two enlarged, involved, fixed lymph nodes, right supraclavicular fossa
10	5	M	Right	Teratoma, mediastinum	Extension into right supraclavicular fossa
11	44	F	Left	Carcinoma of breast	Metastasis to left supraclavicular lymph nodes
12	20	M	Left	Hodgkin's disease	Involvement of left supraclavicular lymph nodes

shadows, and "companion shadows" of the first and second ribs. They state that the sharp outer edge of the sternomastoid muscle, when traced downward, becomes continuous with a fine line parallel with the upper border of the clavicle, due to the skin dipping into the supraclavicular fossa. The lines, which are 5 to 7 cm. long and approximately 3 mm. above the clavicles, originate 3 to 4 cm. lateral to the sternoclavicular joints and end approximately 5 cm. medial to the acromioclavicular joints.

The routine position universally used for the vertical 14 × 17-inch postero-anterior films of the chest is ideal for demonstrating the supraclavicular shadows. When the patient's shoulders are rotated forward so that the scapulae are projected away from the lung field, the clavicles move forward and upward, thus increasing the depth of the supraclavicular fossae.

DISCUSSION

Absence of one or both supraclavicular shadows in the 12 cases presented did not result in a diagnosis, as all the patients were already under medical care. The sign, however, was of value to the diagnostic radiologist in determining extent of the disease and the effectiveness of radiation therapy. In Cases 1, 2, 4, 6, 8, 9, and 11 it was the only evidence on the chest films that disease existed. In Cases 3, 10, and 12 absence of the shadows informed the radiologist that the involvement was not confined to the chest and was more extensive than he would have known without this sign. Case 5 illustrates obliteration of a supraclavicular fossa by cutaneous and subcutaneous fibrosis, and in Case 7 a superior vena caval syndrome was responsible. Following irradiation of the supraclavicular masses and the resulting decrease in their size, the supraclavicular shadows reappeared in Cases 1, 2, and 3 (Figs. 5 and 6).

It is reasonable to assume that almost all supraclavicular masses of sufficient size to obliterate the supraclavicular shadow will be detected during a thorough physical examination. The radiologist occasionally may detect a mass which has been overlooked, but in hospital, clinic, and office practice the sign seems of value chiefly in assisting the radiologist in gaining a more accurate impression of the extent of the disease and in increasing accuracy of his written report.

Photoroentgen chest survey studies do not include physical examination. Not only are the examinees not seen by a physician but they are often allowed to remain dressed. As this method of examining chests is in general use, it is apparent that the supraclavicular shadows are of greatest value in such surveys. Evaluation of the shadows routinely will increase the number of examinees recalled for conventional films and clinical investigation, but this should be justified by the number of early lesions detected.

Absence of one or both supraclavicular shadows does not always indicate the presence of pathological lesions. Three conditions—obesity, gross malpositioning, and extremely sloping shoulders—all of which are recognizable, have been observed to obliterate one or both shadows. In order to establish the frequency of normal supraclavicular shadows, 1,000 consecutive 14 × 17-inch chest films of healthy young adults, 100 films of gravid women, and 100 films of men over sixty years of age were studied. Eighty-eight per cent of the 1,000 young adults, 79 per cent of the older men, and 77 per cent of the gravid women had normal bilateral shadows. Eight hundred seventy 70-mm. photoroentgen films of the chest made during pre-employment examination were studied to determine the percentage of normal supraclavicular shadows, as compared with the 14 × 17-inch films. Although the shadows seemed to stand out more prominently on the 70-mm. films, only 73 per cent showed normal shadows bilaterally; 18 per cent showed total absence of the shadows; 9 per cent showed one shadow to be absent. The high percentage of absence of the shadows in this series can be largely explained by the number of very obese

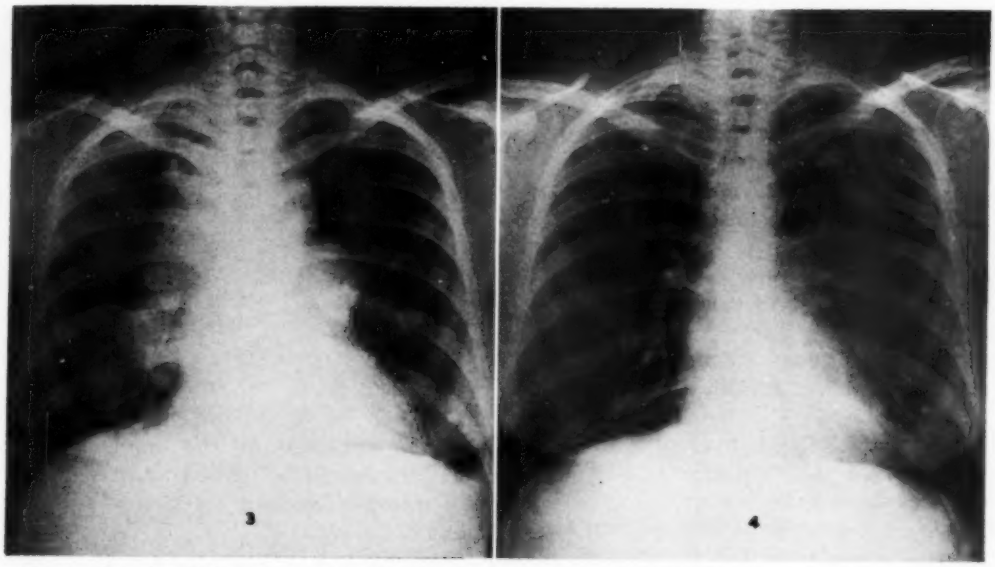

Fig. 3. Case 2. Obliteration of the right supraclavicular shadow, indicating involvement of the supraclavicular nodes in addition to obvious mediastinal and hilar disease.
Fig. 4. Case 2. Reappearance of right supraclavicular shadow following radiation therapy.

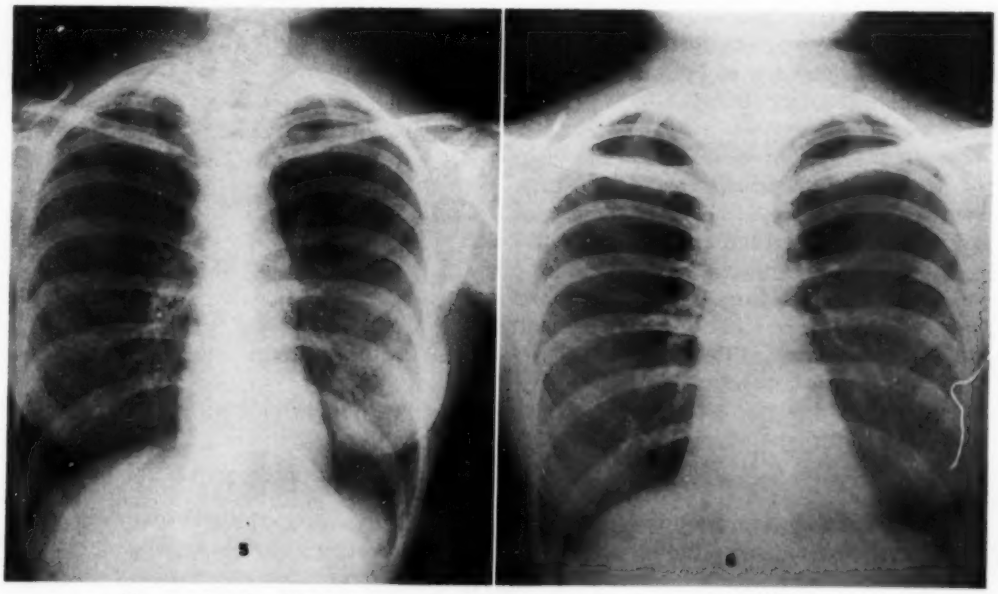

Fig. 5. Case 3. Bilateral absence of the supraclavicular shadows; Hodgkin's disease.
Fig. 6. Case 3. Return of supraclavicular shadows following radiation therapy.

charwomen being examined. In almost every case where one or both shadows were absent, it was obvious from the film that the patient was overweight or that the position was poor. In all series, the shadows were present in almost 100 per cent of the films of subjects of normal or subnormal weight.

A sufficient number of chest films of very young normal children have been studied to show that the supraclavicular shadows are frequently not present, and none have been observed on the films of infants.

A study was initiated to determine how large a mass must be in order to obliterate a supraclavicular fossa. It was concluded that such information would apply only to the test subject because of varying anatomical relationships of the supraclavicular regions.

Since all postero-anterior films of the chest of normal individuals do not show supraclavicular shadows, it is necessary in each instance in which one or both shadows are absent that the interpreter determine whether normal shadows should be present. If the appearance of the patient's soft tissues, position of the diaphragm, etc., indicate obesity, bilateral absence is likely and the sign is unreliable. If the soft tissues indicate an individual of normal or subnormal weight, absence of one supraclavicular shadow should be considered abnormal and absence of both viewed with suspicion.

CONCLUSIONS

Tumors or other disease processes which result in obliteration of the supraclavicular fossae can be detected roentgenographically by absence of one or both of the supraclavicular shadows. These shadows have been described and their use as aids in diagnosis presented. Twelve cases showing abnormal supraclavicular shadows produced by disease have been briefly presented and several are illustrated. Frequency of normal supraclavicular shadows and alterations of the shadows by nonpathological conditions have been discussed.

That this sign enables the radiologist to detect the presence of lesions not otherwise roentgenographically evident has been pointed out. It is believed that the greatest value of the supraclavicular shadows is in chest survey examinations.

RECOMMENDATIONS

1. An evaluation of the supraclavicular shadows should be made routinely during the interpretation of all postero-anterior films of the chest.
2. If the shadows are present bilaterally and are normal in appearance, no comment should be made concerning them.
3. Unilateral absence should be reported and investigated clinically, provided the film does not indicate obesity or gross malposition.
4. Bilateral absence may be significant and should be investigated when the patient is of normal or subnormal weight.

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REFERENCE

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SUMARIO

Las Imágenes Supraclaviculares en la Interpretación de las Radiografías Torácicas

Las sombras supraclaviculares que se encuentran presentes normalmente en las radiografías postero-anteriores del tórax pueden faltar cuando existen en el cuello tumefacciones, primarias o metastáticas, que obliteran parcial o completamente las fosas supraclaviculares. Ese signo es de valor para el radiólogo diagnosticador al tratar de determinar la extensión de un proceso patológico y la eficacia de la radioterapia. Es en particular útil en las encuestas roentgenofotográficas del tórax, que no comprenden una exploración física.

Hay que excluir tres factores no patológicos que conducen a la obliteración de las sombras supraclaviculares: obesidad, defectos exagerados en la posición para la radiografía y hombros sumamente caídos.

Tabúlanse 12 casos en los que ese signo revistió importancia diagnóstica.

Roentgen Findings in the Skull and Chest in 1,030 Newborn Infants[1]

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ROENTGEN findings in the newborn with special reference to the skull and chest are the subject of this report. Specific features include: mineralization of the nasal bone, herniation of the pulmonary apices, fracture of the clavicle, ossification centers for the interparietal bone, accessory occipital ossicles, hyoid body, hyoid horns, anterior arch of the atlas, coracoid processes and humeral heads. These features are shown schematically in Figures 1 and 2.

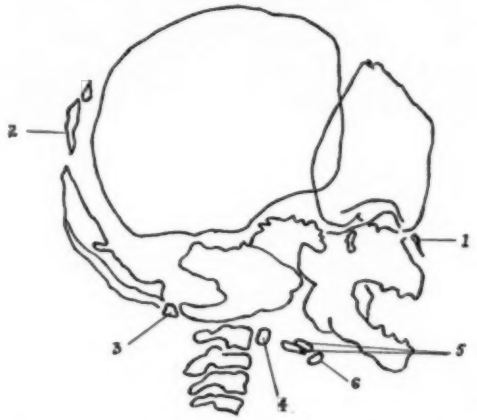

Fig. 1. Schematic drawing of skull, lateral view, showing: (1) mineralized nasal bone; (2) interparietal bone; (3) extra occipital ossicle; (4) ossification center of anterior arch of the atlas; (5) hyoid horns; (6) hyoid body.

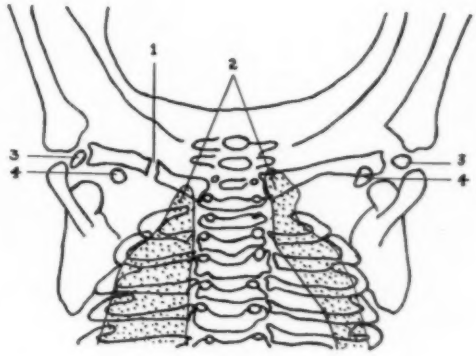

Fig. 2. Schematic drawing of chest, postero-anterior view, showing (1) fracture of clavicle; (2) herniation of pulmonary apex; (3) ossification center of humoral head; (4) ossification center of coracoid.

MATERIAL

The group of 1,030 infants upon which this study is based were born at the Sloane Hospital during the years 1945–50.[2] A lateral film of the skull and a postero-anterior film of the chest of each newborn child were taken during the first four days of life. Case selection was random. Of the 493 males, 304 were white and 189 Negro; of the 537 females, 343 were white and 194 Negro (Table I,A). All premature (*weight under 2,500 grams*) infants were excluded.

Most mothers (Table I,A), both Negro and white, were in the age group 26 to 35. Distribution of maternal age for both races in percentage was: 25 years or younger, 38 per cent; 26 to 35 years, 48 per cent; 36 years and older, 14 per cent. The ages of white and Negro mothers were similar. Infantile sex did not vary with age or race of the mother (Table I). Birth weights were distributed as follows: 2,500–2,999 grams, 26 per cent; 3,000 to 3,999 grams, 68 per cent; 4,000 grams and over, 6 per cent. Birth

[1] From the Department of Radiology of the College of Physicians and Surgeons of Columbia University and the Radiological Service of the Presbyterian Hospital, New York, N. Y. Accepted for publication in August 1952.

[2] These roentgen examinations were part of a larger study of newly born infants directed by Dr. Katherine Merritt on the "Relation of Maternal Infections during Pregnancy to Fetal Malformations," which was supported by the Life Insurance Medical Research Fund, the Rockefeller Foundation, and the Department of Health, State of New York.

TABLE I: TABULATION OF INFANTS ACCORDING TO SEX AND RACE (A) WITH REGARD TO MOTHER'S AGE AND (B) WITH REGARD TO BIRTH WEIGHT*

	Total	A. Mother's Age (years)			B. Birth Weight (gm.)		
		25	26–35	35–	2,500–2,999	3,000–3,999	4,000–
Grand total	1,030	397(38)	504(48)	129(14)	271(26)	692(68)	67(6)
Total males	493	191(39)	233(47)	69(14)	110(40)	347(71)	36(7)
Total females	537	206(39)	271(51)	60(9)	161(32)	345(74)	31(6)
White males	304	117(38)	146(49)	41(13)	55(18)	224(74)	25(8)
White females	343	122(36)	185(54)	36(10)	89(26)	231(67)	23(7)
Negro males	189	74(39)	87(46)	28(15)	55(29)	123(65)	11(6)
Negro females	194	84(43)	86(44)	24(13)	72(37)	114(59)	8(4)

* Numbers not in parentheses are numbers of infants studied. Numbers in parentheses represent the percentage in each group.

TABLE II: NUMBER AND PERCENTAGE OF OSSIFICATION CENTERS PRESENT AND HERNIATION OF LUNG APEX IN ENTIRE GROUP OF INFANTS WITH BREAKDOWN ACCORDING TO SEX AND RACE*

	Total Male and Female	A. Male			B. Female		
		White	Negro	Total	White	Negro	Total
Anterior arch of atlas	270(27)	74(24)	56(29)	130(28)	87(25)	53(22)	140(25)
Hyoid							
Body	595(60)	188(61)	99(59)	287(59)	205(60)	103(52)	308(57)
Horns	585(59)	215(71)	96(48)	311(63)	183(53)	91(46)	274(51)
Body and horns	528(53)	188(61)	80(42)	268(54)	176(51)	84(44)	260(48)
Anterior arch of atlas and both horns and body of hyoid	183(18)	49(16)	36(19)	85(18)	62(18)	36(18)	98(17)
Interparietal	120(12)	30(10)	22(11)	52(10)	53(15)	15(8)	68(12)
Occipital ossicle							
Single	7(0.7)	2(0.7)	0	2(0.4)	2(0.7)	3(1)	5(0.9)
Multiple	1(0.1)	1(0.3)	0	1(0.2)	0	0	0
Coracoid							
Right	202(20)	52(17)	49(26)	101(20)	46(13)	55(28)	101(18)
Left	201(20)	52(17)	48(25)	100(20)	46(13)	55(28)	101(19)
Bilateral	201(20)	52(17)	48(25)	100(20)	46(13)	55(28)	101(19)
Humeral head							
Right	184(18)	65(21)	26(13)	91(18)	56(16)	37(19)	93(17)
Left	184(18)	65(21)	26(13)	91(18)	56(16)	37(19)	93(17)
Bilateral	184(18)	65(21)	26(13)	91(18)	56(16)	37(19)	93(17)
Coracoid and humeral head: bilateral	60(5)	18(6)	12(6)	30(6)	20(6)	10(5)	30(5)
Fractured clavicle							
Right	4(0.4)	3(0.1)	0	3(0.6)	0	1(0.5)	1(0.2)
Left	8(0.8)	1(0.3)	2(0.1)	3(0.6)	3(19)	2(1)	5(0.9)
Bilateral	0	0	0	0	0	0	0
Herniated lung apex							
Right	10(1)	2(0.6)	4(2)	6(1)	1(0.3)	3(1)	4(0.7)
Left	10(1)	2(0.6)	4(2)	6(1)	1(0.3)	3(1)	4(0.7)
Bilateral	10(1)	2(0.6)	4(2)	6(1)	1(0.3)	3(1)	4(0.7)

* Numbers in parentheses represent the percentage in each group.

weight was not affected by maternal age or color.

OBSERVATIONS

Nasal Bone: Mineral content and size of the nasal bone are of interest because hypoplasia of the nasal bone has been reported in mongolism (3). In 3 of 1,030 full-term newborn infants, the nasal bones were not visible. There were clinical signs of mongolism in 2 of these at birth and also later in follow-up observation during the first year of life. The third infant was suspected of being a mongol at birth but was not seen later.

In a subsequent study of 1,000 additional unselected newborn infants, there were 3 examples of non-mineralization of the nasal bone. In none of these were there clinical signs of mongolism, but all

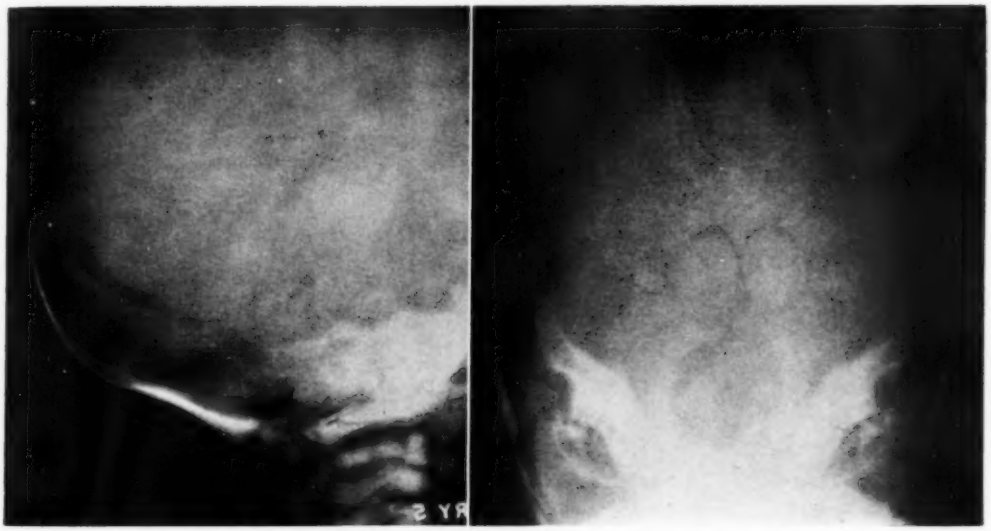

Fig. 3. Lateral film of the skull showing accessory occipital ossicle.
Fig. 4. Towne projection of skull shown in Fig. 3, showing that four accessory occipital ossicles are present (retouched).

3 were premature. In films made of 2 of these 3 premature infants at one year, the nasal bone was mineralized but very small. As pointed out above, premature infants were excluded in the original study of 1,030 infants, a group in which 0.3 per cent showed failure of mineralization of the nasal bone. In a series of 5,000 infants of which our group of 1,030 is part, there were 8 with conclusive clinical signs of mongolism, or 0.16 per cent, which is exactly one-half the incidence of hypoplasia with poor mineralization of the nasal bones in the original group. A review of films of all 8 mongols showed mineralization of the nasal bone in 3. Other authors writing on this subject give a clinical incidence of 0.15 per cent (1). In 5 mongols not included in the newborn groups, who lived longer than ten years, the nasal bone had not mineralized in any.

Absence of mineralization of the nasal bone appears not to be an invariable finding in mongolism.

Ossification Center of Anterior Arch of Atlas: The ossification center of the anterior arch of the atlas (Table II) was present in 27 per cent of the cases. When the mother's age and baby's weight were tabulated without regard to race or sex, no significant differences were found. When, however, the infants were separated as to race and sex, and mother's age and baby's weight were considered separately, it was found that in female white infants the anterior arch of the atlas occurred most frequently (Table V,A and B). The older the mother and the heavier the baby, the greater the incidence of the atlas center. The percentage incidence was almost doubled in both instances, *i.e.*, in the infants of the mothers younger than 25 years the anterior arch was visible in 29 per cent, and of mothers older than 36 years in 50 per cent. In the babies who weighed less than 3,000 grams the arch was seen in 18 per cent and in those who weighed more than 4,000 grams in 35 per cent.

Accessory Ossicles in the Occipital Bone: In a single lateral projection, independent ossicles were identified in the innominate synchondroses (Fig. 3), between the exoccipital and supraoccipital segments of the occipital bone, in 8 of 1,030 infants or 0.8 per cent. When Towne projections of these same 8 skulls were made (Fig. 4) single, double, triple, and quadruple ossicles were

TABLE III: INCIDENCE OF OSSIFICATION CENTERS AND HERNIATION OF LUNG APEX IN MALE WHITES ACCORDING TO (A) MOTHER'S AGE AND (B) INFANT'S WEIGHT*

	Total	A. Mother's Age (years)			B. Infant's Weight (gm.)		
		25	26–35	36–	2,500	3,000	4,000
Total male white	304	117(38)	146(49)	41(13)	55(18)	224(74)	25(8)
Anterior arch of atlas	74(24)	31(26)	34(23)	9(22)	13(24)	56(25)	5(20)
Hyoid							
Body	188(61)	70(60)	89(61)	29(71)	34(62)	136(61)	18(72)
Horns	215(71)	70(60)	120(82)	25(61)	27(49)	169(75)	19(76)
Body and horns	188(61)	67(58)	96(65)	25(61)	26(48)	147(66)	15(60)
Anterior arch of atlas and horns and body of hyoid	49(16)	21(18)	21(14)	7(13)	9(16)	37(16)	3(12)
Interparietal	30(10)	13(12)	14(9)	3(7)	2(3)	26(11)	2(8)
Occipital ossicle							
Single	2(0.7)	2(0.2)	0	0	0	2(1)	0
Multiple	1(0.3)	0	0	1(0.2)	0	1(0.5)	0
Coracoid							
Right	52(17)	26(22)	22(15)	4(10)	4(7)	44(20)	4(16)
Left	52(17)	26(22)	22(15)	4(10)	4(7)	44(20)	4(16)
Bilateral	52(17)	26(22)	22(15)	4(10)	4(7)	44(20)	4(16)
Humeral head							
Right	65(21)	30(26)	29(20)	6(15)	10(18)	48(21)	7(28)
Left	65(21)	30(26)	29(20)	6(15)	10(18)	48(21)	7(28)
Bilateral	65(21)	30(26)	29(20)	6(15)	10(18)	48(21)	7(28)
Both coracoids and humeral heads	18(6)	10(8)	7(4)	1(2)	1(1.8)	15(0.6)	2(0.8)
Fractured clavicle							
Right	3(1)	0	1(0.7)	2(5)	0	2(1)	1(4)
Left	1(0.3)	1(0.8)	0	0	0	1(0.5)	0
Bilateral	0	0	0	0	0	0	0
Herniated lung apex							
Right	2(0.6)	1(0.8)	1(0.7)	0	1(1.8)	1(0.5)	0
Left	2(0.6)	1(0.8)	1(0.7)	0	1(1.8)	1(0.5)	0
Bilateral	2(0.6)	1(0.8)	1(0.7)	0	1(1.8)	1(0.5)	0

* Numbers in parentheses represent the percentage in each group.

demonstrated. In a larger study of 3,800 neonatal skulls for accessory ossicles in the innominate synchondroses, they were found in 15 or 0.4 per cent. These figures represent the incidence as determined by a single lateral projection of each skull. Undoubtedly small accessory ossicles were missed because they were superimposed on the heavier shadows of the edges of the supraoccipital bone. The true incidence of these accessory ossicles can be determined only by routine Towne projections of a large series of neonatal skulls. It can be predicted that the incidence will be shown to be substantially increased by this method as compared with our study using the lateral projection only.

All of the ossicles were situated in the cartilage directly behind the foramen magnum, and most of them were near the midsagittal plane of the head. All projected externally beyond the outer table of the neighboring supraoccipital bone (Figs. 3 and 4). In several cases Kerkring's midline ossicle was found in association with the more laterally placed larger accessory ossicle. In all cases which were followed through the first year, the accessory ossicles were found to have fused with the supraoccipital bone (2).

Hyoid Bone: Hyoid Body: Of all the ossification centers studied, that of the hyoid body was found most frequently, in 60 per cent of all cases (Table IIA). There was no difference in its incidence according to race or sex or infantile weight or maternal age (3).

Hyoid Horns: Ossification centers of the hyoid horns were present in about the same percentage as for the hyoid body, 59 per cent. There were more male whites with this center (71 per cent) than male Negroes (48 per cent) (Table IIA). A much smaller difference was found in females: white 53 per cent; Negro 46 per cent. Infant's weight and mother's age

TABLE IV: INCIDENCE OF OSSIFICATION CENTERS AND HERNIATION OF LUNG APEX IN MALE NEGROES ACCORDING TO (A) MOTHER'S AGE AND (B) INFANT'S WEIGHT*

	Total	A. Mother's Age (years)			B. Infant's Weight (gm.)		
		25	26–35	36–	2,500	3,000	4,000
Total male Negroes	189	74(39)	87(46)	28(15)	55(29)	123(65)	11(6)
Anterior arch of atlas	56(29)	19(26)	22(25)	5(18)	16(29)	35(29)	5(45)
Hyoid							
Body	99(52)	33(45)	53(61)	13(48)	37(67)	57(46)	5(45)
Horns	96(50)	53(72)	30(34)	13(48)	45(82)	26(21)	5(45)
Body and horns	80(42)	28(38)	30(34)	12(43)	32(58)	23(19)	5(45)
Anterior arch of atlas and horns and body of hyoid	36(19)	8(11)	24(27)	4(14)	10(18)	22(18)	4(36)
Interparietal	22(11)	10(13)	7(8)	5(18)	7(13)	15(12)	0
Occipital ossicle							
Single	0	0	0	0	0	0	0
Multiple	0	0	0	0	0	0	0
Coracoid							
Right	49(26)	3(4)	43(50)	2(7)	6(11)	34(28)	3(27)
Left	48(26)	3(4)	42(49)	2(7)	6(11)	33(27)	3(27)
Bilateral	48(26)	3(4)	43(50)	2(7)	6(11)	34(28)	3(27)
Humeral head							
Right	26(13)	3(4)	21(24)	2(7)	6(11)	17(14)	3(27)
Left	26(13)	3(4)	21(24)	2(7)	6(11)	17(14)	3(27)
Bilateral	26(13)	3(4)	21(24)	2(7)	6(11)	17(14)	3(27)
Both coracoids and humeral heads	12(7)	2(3)	8(9)	2(7)	2(3)	9(7)	1(9)
Fractured clavicle							
Right	0	0	0	0	0	0	0
Left	2(0.1)	0	2(2)	0	0	2(1)	0
Bilateral	0	0	0	0	0	0	0
Herniated lung apex							
Right	4(2)	3(4)	0	1(3)	2(3)	2(1)	0
Left	4(2)	3(4)	0	1(3)	2(3)	2(1)	0
Bilateral	4(2)	3(4)	0	1(3)	2(3)	2(1)	0

* Numbers in parentheses represent the percentage in each group.

TABLE V: INCIDENCE OF OSSIFICATION CENTERS AND HERNIATION OF LUNG APEX IN FEMALE WHITES ACCORDING TO (A) MOTHER'S AGE AND (B) INFANT'S WEIGHT*

	Total	A. Mother's Age (years)			B. Infant's Weight (gm.)		
		25	26–35	36–	2,500	3,000	4,000
Total female whites	343	122(36)	185(50)	36(10)	89(26)	231(62)	23(7)
Anterior arch of atlas	87(25)	35(29)	39(21)	13(50)	16(18)	63(27)	8(35)
Hyoid							
Body	205(60)	86(70)	90(49)	29(81)	57(64)	132(58)	16(70)
Horns	183(53)	75(61)	83(45)	25(70)	47(53)	122(54)	14(61)
Body and horns	176(51)	74(60)	78(42)	24(67)	44(50)	118(51)	14(61)
Anterior arch of atlas and horns and body of hyoid	62(18)	22(18)	30(16)	10(28)	12(13)	45(20)	5(22)
Interparietal	53(15)	14(11)	33(18)	6(17)	10(11)	41(18)	2(9)
Occipital ossicle							
Single	2(17)	0	2(1)	0	0	2(0.8)	0
Multiple	0	0	0	0	0	0	0
Coracoid							
Right	46(13)	22(18)	20(11)	4(11)	13(15)	30(13)	3(13)
Left	46(13)	22(18)	20(11)	4(11)	13(15)	30(13)	3(13)
Bilateral	46(13)	22(18)	20(11)	4(11)	13(15)	30(13)	3(13)
Humeral head							
Right	56(16)	15(12)	34(18)	7(19)	10(11)	40(17)	6(26)
Left	56(16)	15(12)	34(18)	7(19)	10(11)	40(17)	6(26)
Bilateral	56(16)	15(12)	34(18)	7(19)	10(11)	40(17)	6(26)
Both coracoids and humeral heads	20(6)	5(4)	14(8)	1(3)	4(4)	15(6)	1(4)
Fractured clavicle							
Right	0	0	0	0	0	0	0
Left	3(0.9)	1(0.8)	1(0.5)	1(3)	0	2(0.8)	1(4)
Bilateral	0	0	0	0	0	0	0
Herniated lung apex							
Right	1(0.3)	0	1(0.5)	0	0	1(0.4)	0
Left	1(0.3)	0	1(0.5)	0	0	1(0.4)	0
Bilateral	1(0.3)	0	1(0.5)	0	0	1(0.4)	0

* Numbers in parentheses represent the percentage in each group.

did not modify the incidence (Tables III–VI).

Combination of Hyoid Body and Horns: Ossification centers for both the hyoid body and hyoid horns were seen in the same infant in 53 per cent of all cases (Table II); ossification centers of horns or body alone in 7 per cent.

absent. Tompsett and Donaldson (4) reported 11 such cases in a series of 500. Our higher incidence might be due to the larger number of neonates examined in our group.

Interparietal Bone: The interparietal ossification center or centers—for often they were multiple—were present in 12

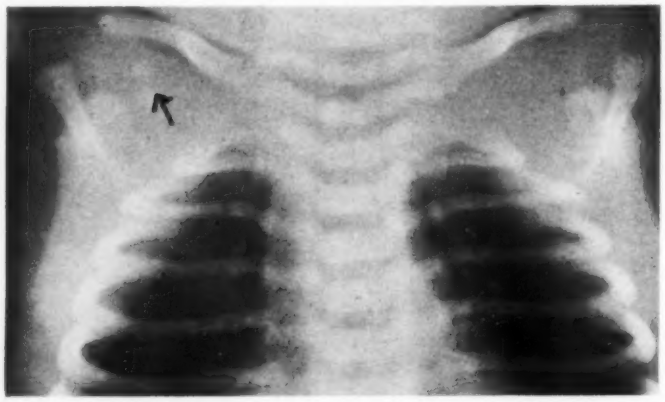

Fig. 5. Postero-anterior film of chest showing unilateral right-sided coracoid process.

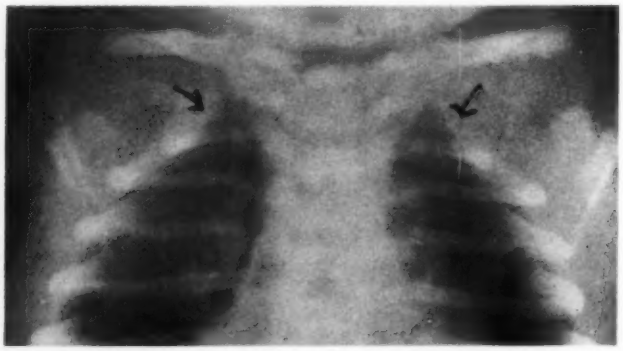

Fig. 6. Postero-anterior film of chest showing herniation of both pulmonary apices.

Combination of Ossification Centers of Hyoid Body, Horns, and Anterior Arch of the Atlas: This triad was present in 18 per cent of cases. Baby's weight, race, sex, and maternal age did not affect the incidence of these three features in combination.

In 59 of 1,030 infants the ossification center of the anterior arch of the atlas was present, but hyoid body and horns were

per cent of the infants. No factor appeared to be significant in the prevalence of the interparietal centers. It is important not to confuse the anomaly with a fracture fragment of the skull.

Coracoid Processes and Humeral Heads: The centers for the coracoid processes and humeral heads were most interesting, for they were, with one exception, present bilaterally. This single exception was a

TABLE VI: INCIDENCE OF OSSIFICATION CENTERS AND HERNIATION OF LUNG APEX IN FEMALE NEGROES ACCORDING TO (A) MOTHER'S AGE AND (B) INFANT'S WEIGHT*

	Total	A. Mother's Age (years)			B. Infant's Weight (gm.)		
		25	26–35	36–	2,500	3,000	4,000
Total female Negroes	194	84(43)	86(40)	24(13)	72(37)	114(59)	8(4)
Anterior arch of atlas	53(22)	29(34)	27(31)	7(29)	20(28)	30(26)	3(38)
Hyoid							
Body	103(52)	51(61)	40(46)	12(50)	51(71)	47(41)	6(75)
Horns	91(46)	42(50)	38(44)	11(50)	34(47)	52(45)	5(62)
Body and horns	84(44)	41(50)	32(37)	11(50)	32(45)	47(41)	5(62)
Anterior arch of atlas and horns and body of hyoid	36(18)	19(22)	11(13)	6(25)	12(16)	21(19)	3(38)
Interparietal	15(8)	3(3)	8(9)	4(17)	3(4)	10(9)	2(25)
Occipital ossicle							
Single	3(1)	2(2)	1(1)	0	0	3	0
Multiple	0	0	0	0	0	0	0
Coracoid							
Right	55(28)	24(29)	26(30)	5(20)	19(26)	32(28)	4(50)
Left	55(28)	24(29)	26(30)	5(20)	19(26)	32(28)	4(50)
Bilateral	55(28)	24(29)	26(30)	5(20)	19(26)	32(28)	4(50)
Humeral head							
Right	37(19)	15(18)	18(21)	4(17)	6(8)	28(24)	3(38)
Left	37(19)	15(18)	18(21)	4(17)	6(8)	28(24)	3(38)
Bilateral	37(19)	15(18)	25(30)	4(17)	6(8)	28(24)	3(38)
Both coracoids and humeral heads	10(5)	4(5)	3(3)	3(13)	2(2)	6(5)	2(25)
Fractured clavicle							
Right	1(0.5)	0	1(1)	0	0	1(0.5)	0
Left	2(1)	1(1)	1(1)	0	1(1)	1(0.5)	0
Bilateral	0	0	0	0	0	0	0
Herniated lung apex							
Right	3(1)	3(3)	0	0	1(1)	1(0.5)	1(12)
Left	3(1)	3(3)	0	0	1(1)	1(0.5)	1(12)
Bilateral	3(1)	3(3)	0	0	1(1)	1(0.5)	1(12)

* Numbers in parentheses represent the percentage in each group.

TABLE VII: DATA ON DELIVERIES OF INFANTS WHO SUSTAINED FRACTURED CLAVICLES

Number of Previous Pregnancies	Presentation	Position	Duration of Labor	Age of Mother	Infant's Weight (gm.)	Comment of Obstetrician
Right Clavicle						
1	Vertex	LOA	12 hr.	28	3,520	Trouble with shoulders
2	Vertex	ROA	13 hr., 8 min.	36	3,950	NSD*
0	Vertex	ROP	9 hr.	24	3,420	Kiellard forceps
0	Vertex	ROP	11 hr., 35 min.	34	3,860	Fibroids; low forceps
0	Vertex	LOA	2 hr., 42 min.	26	3,340	NSD*
4	Vertex	LOA	7 hr., 40 min.	37	4,020	Low forceps
0	Vertex	LOA	9 hr., 43 min.	26	3,740	Low forceps
Left Clavicle						
0	Vertex	LOA	8 hr., 11 min.	20	3,190	NSD*
0	Vertex	ROP	13 hr., 36 min.	25	3,570	Mid forceps
0	Vertex	LOA	3 hr., 26 min.	33	2,970	NSD*
0	Vertex	LOA	2 hr., 20 min.	29	3,770	Low forceps
5	Vertex	LOA	4 hr., 3 min.	39	3,400	NSD*

* NSD—Normal spontaneous delivery.

unilateral right-sided coracoid process (Fig. 5). The coracoid processes were present in 20 per cent and the humeral heads in 18 per cent of all cases. None of the factors considered appeared to be significant for their occurrence. A combination of both humeral heads and coracoid processes was noted in but 5 per cent of all cases.

Fracture of the Clavicles: A fractured clavicle was found in 12 of the 1,030 infants (Table II) and it was never bilateral. The left clavicle was fractured twice as frequently as was the right, 8 cases as compared with 4.

Obstetricians state that fracture of the clavicle occurs in breech and vertex pres-

entations with about equal frequency. In this study all the fractures occurred in vertex presentations. In only 1 instance was there difficulty in delivery of the shoulders (Table VII). In 5 of the 12 cases delivery was normal and spontaneous. The labors were not unduly long, the longest being thirteen and a half hours. Four of the 12 mothers were multiparas (Table VII).

Herniation of the Pulmonary Apices: Ten of the 1,030 infants showed air-containing lung above the first rib (Fig. 6). The herniation was bilateral in all cases. Review of the charts in these babies revealed that they were asymptomatic.

According to Van Wezel (5), "cervical hernia (of the lung) usually occurs through the superior aperture of the thorax in the space between the sternocleidomastoid muscle and the scalenus anticus muscle, either a tear in the traumatic cases or as a deficiency in Sibsons' fascia in the congenital group." No trauma was observed in our cases nor were there any congenital anomalies. Our experience indicates that cervical herniation of the lungs during the first days of life is usually not significant clinically and needs no treatment.

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SUMARIO

Hallazgos Roentgenológicos en el Cráneo y el Tórax de 1,030 Recién Nacidos

Estos estudios roentgenológicos comprendieron 1,030 recién nacidos a término, de los cuales 493 eran varones (304 blancos, 189 negros) y 537 mujeres (343 blancas, 194 negras).

En 3 de la serie, no eran visibles los huesos nasales y en 2 de éstos había signos clínicos de mongolismo al nacer y en los estudios subsiguientes durante el primer año de vida. Sin embargo, opinan los AA. que la falta de mineralización de dichos huesos no representa un hallazgo constante en el mongolismo.

En 27 por ciento de los lactantes, estaba presente el centro de osificación del arco anterior del atlas. Mientras más edad tiene la madre y más pesa el hijo, mayor es la incidencia de ese centro.

Había osículos accesorios en el hueso occipital en 0.8 por ciento, pero parece que esa cifra hubiera sido más alta de haberse ejecutado proyecciones corrientes de Towne además de tomarse una sola vista lateral.

Descubriéronse centros de osificación del hioides en 60 por ciento de los casos, y de las astas del mismo en 59 por ciento, sin que al parecer desempeñaran papel alguno en ese sentido la raza, el sexo, el peso de la criatura o la edad de la madre.

En 12 por ciento, había centro (o centros) de osificación interparietal y en 20 y 18 por ciento de los casos se descubrieron los centros de los coracoides y de las cabezas del húmero, respectivamente. Ninguna de estas características se vió afectada por la raza, el sexo, el peso de la criatura o la edad de la madre.

Hubo fractura de la clavícula en 12 lactantes y hernia del vértice pulmonar en 10. No parece que esta última posea importancia clínica.

Cleidocranial Dysostosis

With a Report of Four Cases[1]

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ALTHOUGH scattered cases of cleidocranial dysostosis were reported early in the latter half of the nineteenth century, the condition was first established as a clinical and pathological entity in 1898 by Marie and Sainton (1). On the basis of their study of 4 cases, they stressed as cardinal features of the disease its hereditary transmission, hypoplasia of the clavicles, increase in the transverse diameter of the skull, and delay in ossification of the fontanelles. They gave the abnormality its name of "cleidocranial dysostosis." In the following year Terry (2) described a female skeleton which, in addition to the pathognomonic changes in the skull and clavicles, showed faulty eruption of the teeth, scoliosis, and poorly ossified pubic and ischial bones.

INCIDENCE

Soule (3) summarized the literature up to 1944, and the interested reader is referred to his complete bibliography. In 100 papers a total of 323 cases were reported from various parts of the world. Of these, 198 were on a hereditary basis and 125 were sporadic, a proportion of about 8 to 5 in favor of a familial tendency. Transmission occurred equally through the male and the female, and the cases were evenly distributed between the sexes. A study of the records of families in which this abnormality appeared suggests that it tends to outbreed itself. Once it disappears from a family, it is said never to recur. The cause is presumably a defect in the parental germ-plasm, a faulty anlage in the skeletal system for membranous bone in particular and especially the clavicle and the cranium.

CLINICAL FEATURES

Patients with cleidocranial dysostosis are usually of small stature. The cranium is disproportionately large, with prominent frontal and parietal bosses. The face is small, the eyes widely spaced, and the nose depressed at the bridge. The chest may show flattening where the outer ends of the clavicles should be, and the shoulders, lacking the splinting effect of the clavicles, are unusually mobile and can be approximated or made to touch anteriorly. The deformity does not interfere with the patient's ability to do ordinary work nor does it affect his general health. The abnormality is usually discovered in the course of an examination for another condition. The deciduous teeth may be normal but in the permanent set faulty eruption, impaction, and other abnormalities may be the major source of complaint directly referable to this condition (Cases III and IV; Figs. 8–11, 15–16).

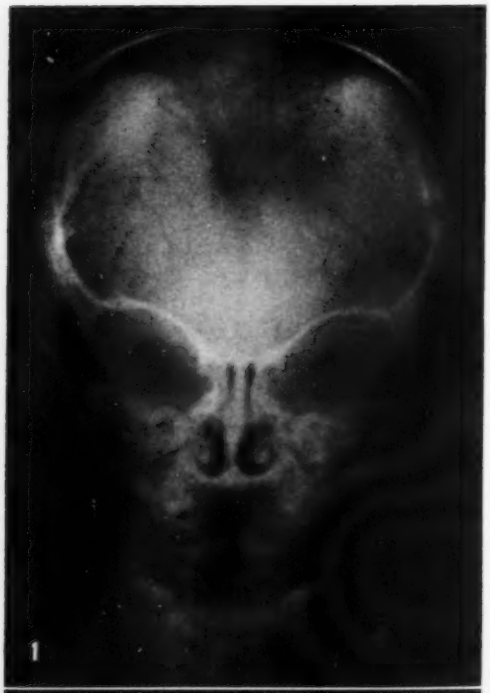
CASE REPORTS

The 4 cases to be recorded here were seen during the summer of 1951 and constitute all the cases of this abnormality encountered by the writer in twenty-four years of general radiological practice.

CASE I: D. D., white female, was born prematurely of normal parents. She had developed normally but had always been underweight. At fifteen months she weighed 18 lb. She had a slight nutritional anemia (hemoglobin 60 per cent). Because of the unusual shape of her head, she was referred at the age of sixteen months for x-ray examination. This was carried out and a correct diagnosis was made by the author's associate, Dr. C. Rotenberg.

X-Ray Findings: The general shape of the skull in the anteroposterior view was that of an inverted pear, the narrow end being represented by the man-

[1] From the Department of Radiology, Mount Sinai Hospital, Toronto, Ontario, Canada. Presented at a joint meeting of the Toronto Radiological Society, the Buffalo Radiological Society, the Rochester Roentgen Ray Society, and the Central New York Roentgen Ray Society, at Toronto, April 5, 1952. Accepted for publication in June 1952.



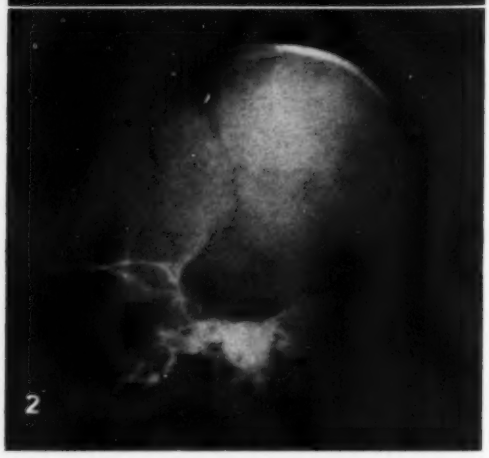


Fig. 1. Case I. Typical pear-shaped brachycephalic skull. Note enlarged anterior fontanelle, through which can be seen the persistent posterior fontanelle. Note also the wormian bones about the lambdoidal suture.

Fig. 2. Case I. Forward extension of anterior fontanelle between the two halves of the frontal bone. Note absence of nasal bones.

dible. The base of the skull was not widened but there was a marked lateral bulging of the parietal eminences causing brachycephaly. The anterior and the posterior fontanelles were still wide open, the anterior extending forward into the metopic suture, posteriorly into the sagittal, and laterally into the frontoparietal sutures. Numerous wormian bones were seen about the lambdoid suture. The orbital margins appeared slightly elliptical. The body of the mandible was still unfused in the mid-line (Figs. 1 and 2).

The right clavicle was small and divided into an inner two-thirds and an outer third, separated by about 1 cm. The inner portion was small, straight, and poorly calcified. The outer portion showed a slight curve, was better calcified, and had a thicker cortex. The medial portion of the left clavicle was slightly better calcified than that of the right. The lateral portion was small and depressed below the level of the inner portion (Fig. 3).

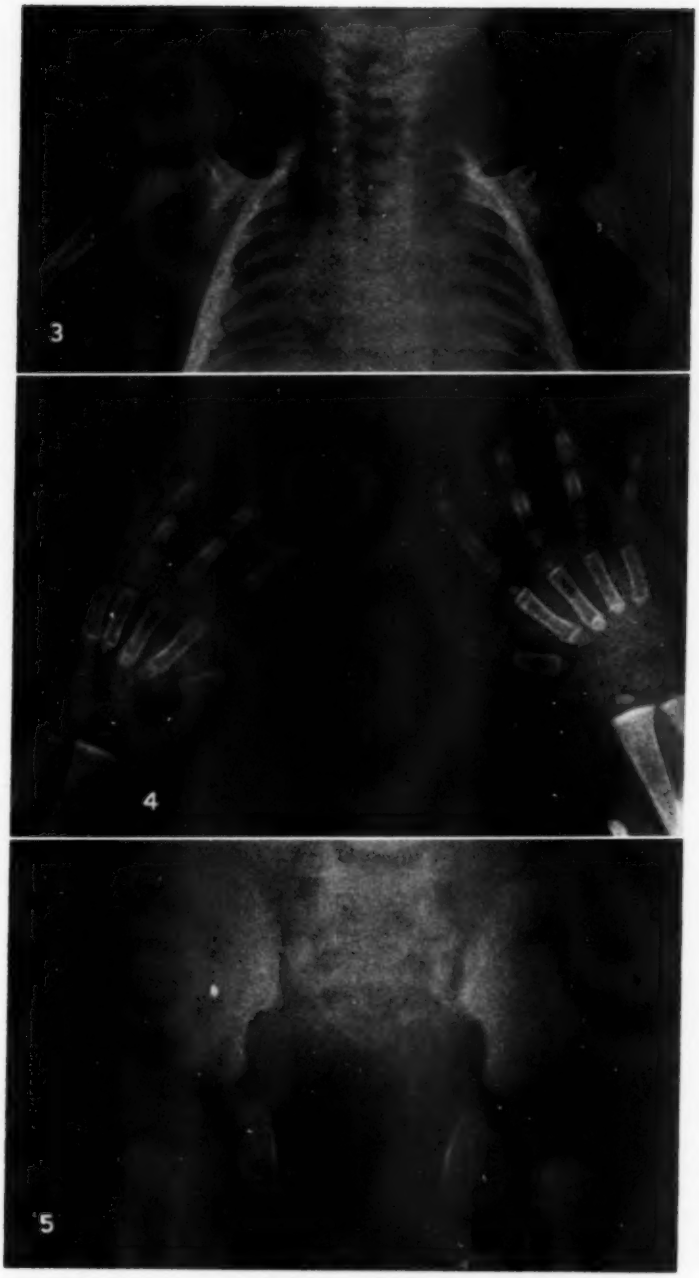
The scapulae showed no ossification of the coracoid processes, which are normally ossified between seven and twelve months.

In the right wrist there was beginning ossification of the os magnum. In the left wrist no ossification centers were seen in the carpal bones, though the os magnum and unciform normally show ossification centers at two to ten months. The right 2nd metacarpal and the left 2nd and 3rd showed capital epiphyses, which finding is within normal limits. The 2nd to the 5th metacarpals in both hands showed basal pseudo-epiphyses. The distal phalangeal epiphyses of the thumbs were oval and there were no terminal tubercles (Fig. 4).

The pelvis showed wide separation of the bones at the acetabulum and still wider at the pubic symphysis. There was no ossification of the pubic bones but the pubic rami had begun to ossify. The capital epiphyses of the femora were rounded at their metaphyseal surfaces and there was increased bone density at the metaphyses (Fig. 5).

CASE II: L. W., white male infant, 3 months old, had presented a feeding problem since birth, with occasional respiratory infections. Attention was drawn to the abnormal softness of the top of the head in the Outpatient Department and the child was referred for x-ray examination of the skull and chest. The cranium was somewhat globular in shape, with marked deficiency of ossification of the cranial bones. The frontal bone was in two halves, which, together with the parietals, had the appearance of islands of bone on a sea of membrane. The parietals were widely separated from each other, from the frontals anteriorly, the occipital behind, and the squamous portions of the temporals below. The greater wings of the sphenoid were not ossified. These deficiencies resulted in marked enlargement of the anterior and posterior fontanelles, with a strip of unossified membrane below the parietal bones on each side (Fig. 6).

The medial two-thirds of the right clavicle was thin, straight, and somewhat osteoporotic. The distal portion was flat, about 5 mm. in length and separated from the medial portion. The medial portion of the left clavicle was similar to that of the



Figs. 3–5. Case I

Fig. 3. Separation of distal portions of clavicles from main medial portions; absence of coracoid processes of scapulae.
Fig. 4. Markedly retarded ossification of carpal bones.
Fig. 5. Wide separation at the pubic symphysis. Note rounded capital femoral epiphyses.

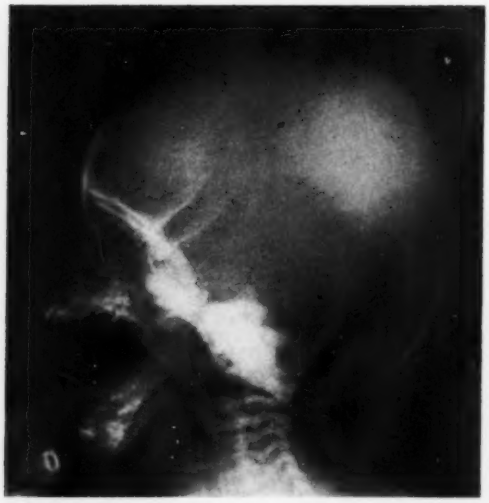


Fig. 6. Case II. Poor ossification of cranial bones. Wide fronto-parietal and parieto-temporal separation.

right but the distal portion was larger and the cortex was thicker.

The scapulae and the rest of the bones of the upper extremities were normal. It is to be noted, however, that the epiphyses of the capitellum and of the olecranon were ossified (Fig. 7). The capitellum has a wide period of ossification up to three years, and a center at three months may still be considered within normal limits. The olecranon, however, normally does not appear till the tenth year and only in 10 per cent of boys is it present at eight and a half years. Its presence here at three months would represent a markedly premature ossification.

The pelvis showed no ossification of the pubic bones or of the rami of the pubes or ischia. There was also unduly wide separation of the bones at the acetabula.

The patient returned for re-examination six and a half months later. He was now nine and a half months old and weighed 19 lb. Roentgen examination revealed increase in the size of the skull and of the ossified portions of the cranium, but the transverse diameter had increased out of proportion to the general enlargement, giving the skull a slight brachycephalic appearance. The right half of the frontal bone had grown more than the left and the frontals and the parietals were more closely approximated than previously. All the cranial bones were thicker, especially the occipital. Beginning outline of wormian bones was seen in the lambdoid suture. There was still a wide unossified strip between the parietals and the temporals on each side. There was no ossification of the nasal bones, and the body of the mandible was unfused across the mid-line.

The wrists now showed a barely perceptible center in the os magnum. Basal epiphyses were seen in the proximal phalanges of the middle and ring fingers of both hands, in the middle phalanges of the left middle, ring, and little fingers, and in the distal phalanges of the thumbs. All of these represent accelerated ossification to some degree.

The pelvis still showed no evidence of ossification in the body of the pubis or its rami.

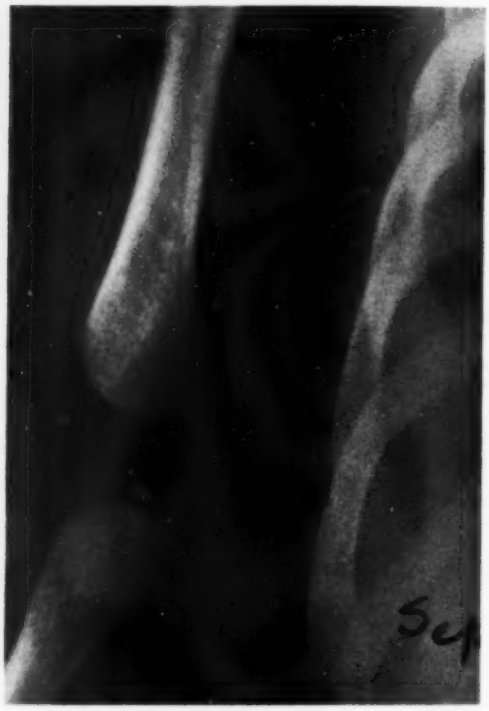
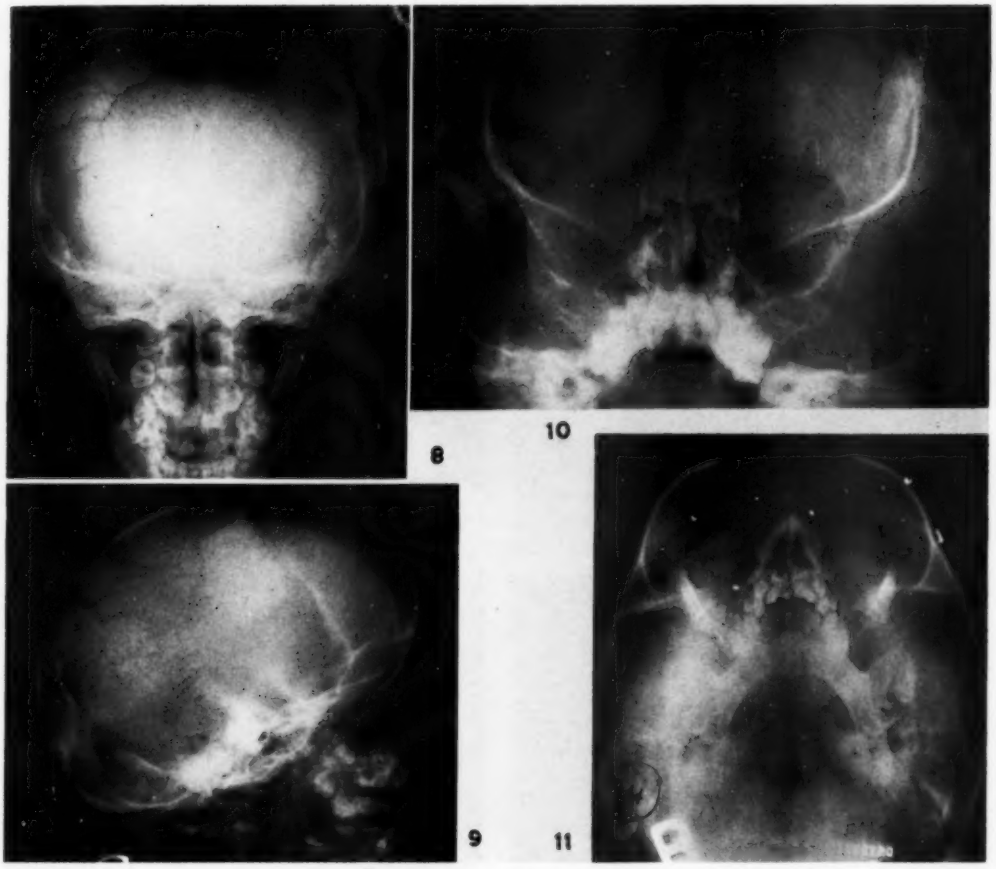


Fig. 7. Case II. Accelerated ossification of capitellum and olecranon. (Enlarged $\times c.$ 4)

CASE III: M. W., a 4-year-old girl, sister of L. W. (Case II), had always been undersized but was active and of normal intelligence. Her weight was 29 lb. Her cranium was enlarged, with marked prominence of the frontal bosses, a mid-line depression from the frontal to the occipital bone, and a large, open anterior fontanelle. The bridge of the nose was flat; the interorbital space was widened and there was some degree of epicanthus. The teeth were not remarkable. The thorax showed a flattening in the lateral clavicular areas where the prominent medial sections of the clavicles could be felt. The acromion processes looked and felt unusually prominent. No supraspinous fossae could be felt. The inferior angles of the scapulae projected posteriorly like wings. The patient could bring the anterior surfaces of the shoulders together. The elbows showed a slight gun-stock deformity. The lower extremities were normal except that the feet were slightly flattened.



Figs. 8–11. Case III

Fig. 8. Markedly brachycephalic skull with delayed ossification. The left parietal bone is less developed than the right.

Fig. 9. Huge anterior fontanelle dividing the two halves of the frontal bone. Note wormian bones and absence of nasal bones.

Fig. 10. Showing metopic suture running through the widened nasal process of the frontal bone. Note zygomatic processes extending forward from temporal bones. Zygomatic processes of malar bones are absent.

Fig. 11. Body of mandible still unfused in mid-line. Note zygomatic processes of temporal bones but no corresponding processes from malar bones.

X-Ray Findings: The skull was large and pear-shaped, platybasic, and markedly brachycephalic. The vertical portion of the frontal showed a metopic suture but above this the frontal bones were widely separated and together with the parietals formed the large anterior fontanelle. The right parietal had grown more toward the mid-line than the left, and the head over the unossified portion was somewhat flattened. Between the temporal and parietal bones on either side was a 2-cm. strip of unossified membrane (Figs. 8 and 9). Ossification in this patient was less advanced at four years than in Case I at sixteen months. Numerous wormian bones were seen in the parietal and lambdoid areas. The nasal process of the frontal bone was widened and the metopic suture passed through it, causing some ocular hypertelorism (Fig. 10). The nasal bones were not ossified. The zygomatic processes of the temporal bones came to a dead end on each side; no processes from the malar bones came backward to meet them. The body of the mandible was still divided in the mid-line (Fig. 11).

Of the right clavicle, only the medial third was present, and this was poorly calcified, straight, and with a thin cortex. On the left side the medial half of the clavicle was present and this resembled the right. The scapulae showed no definite supraspinous fossae and the glenoid fossae were poorly developed. The coracoid processes were not ossified (Fig. 12).

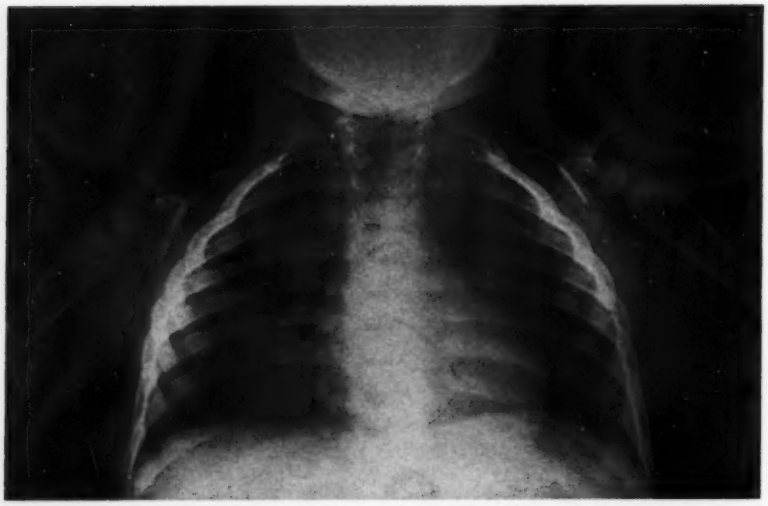


Fig. 12. Case III. Absence of outer portions of both clavicles, the coracoid processes, and supraspinous fossae of the scapulae especially on the left.

Fig. 13. Case III. Delayed ossification of carpal bones, basal metacarpal pseudo-epiphyses, and characteristic slender metacarpals and phalanges.

Small, rounded centers for the os magnum and the unciform were demonstrable in the carpal bones. The 2nd to the 5th metacarpals showed basal pseudo-epiphyses; in the 3rd and the 4th the pseudo-epiphyses were fused with the shafts. There was slight osteoporosis of the metacarpals and the phalanges. In addition, the proximal and middle phalanges were slender in the middle third of the shafts and flared out toward the bases. The middle phalanges of the little fingers were misshapen and shortened. The distal phalanges were slender and without terminal tufts. The epiphyses of the distal phalanges of the thumbs were oval; to a lesser extent this was true of the other distal phalanges (Fig. 13).

The pelvis showed wide separation in the region of the pubes. There was beginning ossification of the superior rami of the ischia. There was also marked separation at the acetabula and to a lesser extent at the sacroiliac joints. The superior walls of the ace-

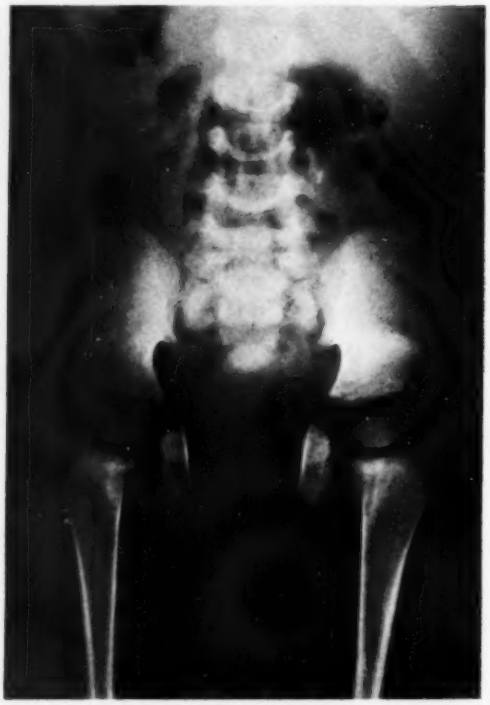


Fig. 14. Case III. Wide separation at symphysis and acetabulum and irregular capital femoral epiphysis and acetabula.

tabula appeared irregular and no cortex was demonstrable. The capital femoral epiphyses were rounded, with a widened and irregular epiphyseal line (Fig. 14).

In the knees, the tibial epiphyseal lines appeared somewhat irregular and wide for the patient's age. A similar appearance was seen in the lower tibial and fibular epiphyses.

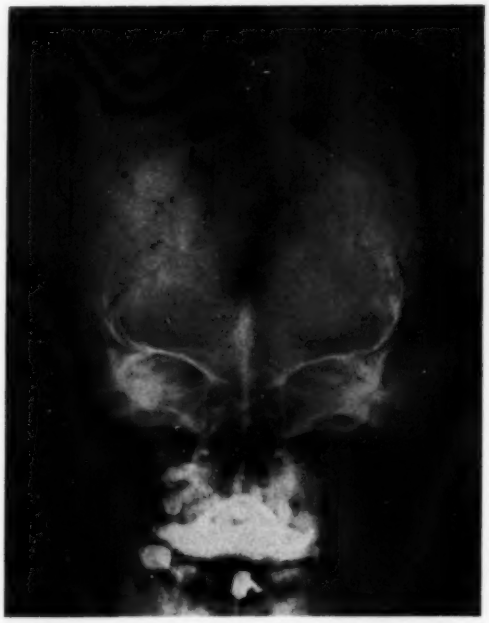


Fig. 15. Case IV. Markedly brachycephalic skull with open anterior fontanelle and shallow mid-sagittal depression.

The bones of the feet showed a slight osteoporosis. There were capital pseudo-epiphyses of the 1st metatarsal, and the basal epiphyses of the proximal phalanges of the big toes were somewhat peg-shaped; those of the distal phalanges were oval.

CASE IV: J. W., age 38, was the father of L. W. and M. W. (Cases II and III). His father had 8 sons by two marriages, the patient being an offspring of the second marriage. He was the only one of the family that "had a large soft head as a child." Both his parents were normal in this respect, but his father had a clubfoot and a deformed hand. He did not remember his grandparents. A younger brother, who was normal, had a child with a clubfoot. The patient's wife was normal.

The patient was 5 ft. 1 in. tall and weighed 110 lb. His head was large and wide, with prominent frontal bosses. The region of the anterior fontanelle was depressed and showed a firm but not a bony resistance on pressure. There was flatness in the region of the zygomatic arches. The anterior lower

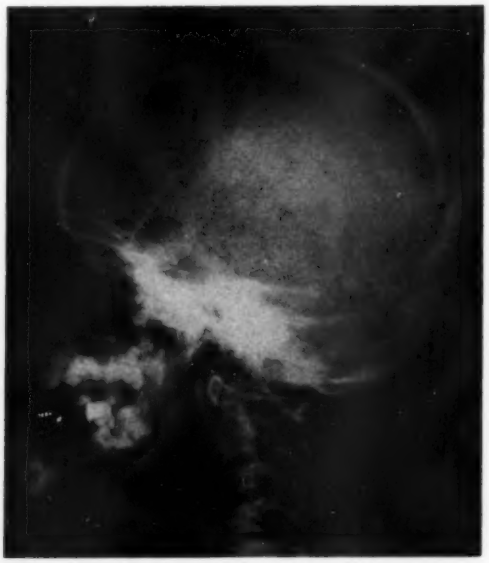


Fig. 16. Case IV. Absence of nasal bones; wormian bones about lambdoid suture; impacted teeth in body of mandible.

teeth were for the most part just in the process of eruption.

A well marked dorsal scoliosis was present. The outer end of the inner portion of the right clavicle was palpable; the left clavicle felt normal. The patient could almost bring his shoulders into contact anteriorly.

X-Ray Findings: The skull was typically pear-shaped and the cranium was large, both absolutely and relatively to the size of the body. There was a shallow depression over the sagittal and mid-frontal sutures, emphasizing the prominent frontal and parietal bosses. In the vertical portion of the frontal, the metopic suture was closed over by dense bone, but the upper parts were still widely separated by the anterior fontanelle. Numerous wormian bones were seen in the lambdoid suture. The nasal bones were not ossified. There was, however, undue prominence of the anterior nasal spine of the superior maxilla (Figs. 15 and 16). The zygomatic processes of the malar and temporal were ununited on either side. The sphenoid bone was short and the sella was shallow and poorly distinguishable. There was rounding of the point of the chin. Many teeth were unerupted and some were impacted.

There was a spina bifida occulta of the lower 4 cervical and upper 9 dorsal vertebrae. Dorsal scoliosis was pronounced and the 5th to the 10th dorsal bodies were flattened.

The right clavicle was small and slender, with a thin cortex. The medial two-thirds showed a normal curve and was separated from the lateral third, the medial end of which appeared clubbed. The left

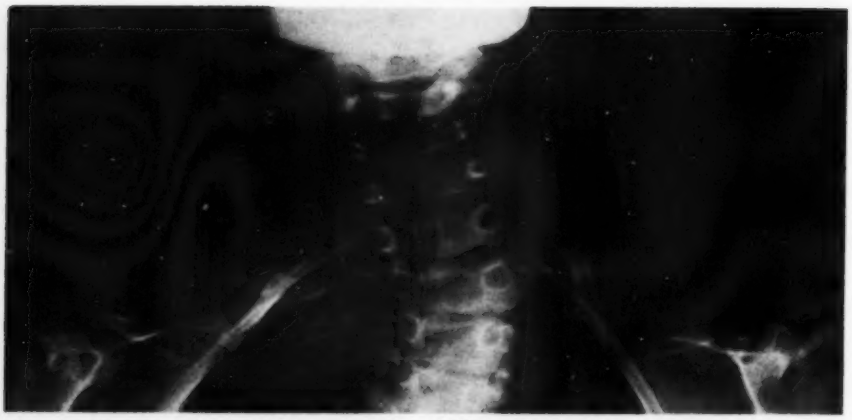
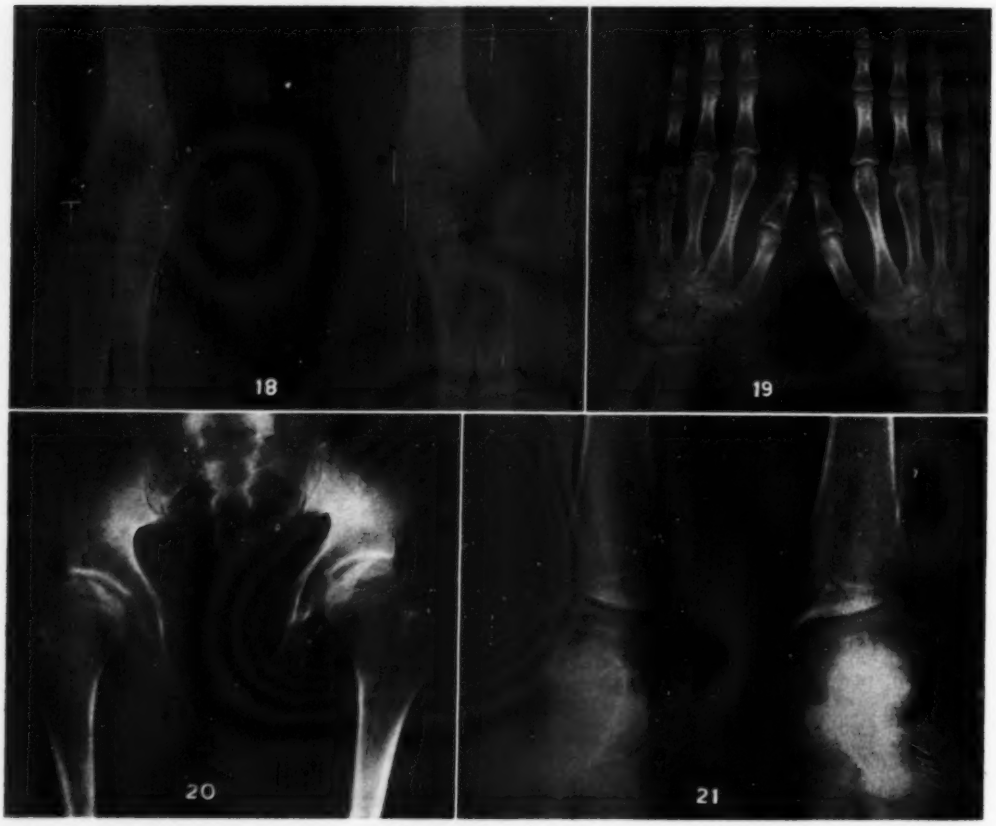


Fig. 17. Case IV. Right clavicle in two parts; left clavicle essentially normal. Spina bifida occulta of cervical vertebrae within tracheal shadow (not well reproduced).



Figs. 18–21. Case IV

Fig. 18. Gun-stock deformity of elbows. Note proximal position of radial head and bowing of ulnar shaft.
Fig. 19. Characteristic appearance of hands: long second metacarpal and step-like proximal recession of succeeding metacarpal heads. Note hypoplasia of unguicular tubercles.
Fig. 20. Asymmetry of pelvis; hypoplasia of left pubo-ischium; enlarged shallow acetabula; enlarged femoral heads and broadened necks.
Fig. 21. Obliquity of tibio-astragalar joints.

clavicle appeared essentially normal (Fig. 17). The scapulae showed shallow supraspinous fossae.

The cortex of the long bones of the arm and forearm was thin. The plane of the humeral trochlea was directed slightly laterally. The head of the radius extended more proximally than normal and this, together with a lateral bowing of the upper ulnar shaft, resulted in a medial deviation of the forearm (Fig. 18).

The trapezium and trapezoid were fused in both wrists. The metacarpals, in general, were long in proportion to the length of the fingers. The 2nd metacarpal, in particular, was strikingly long. The heads of the 2nd to the 5th metacarpals receded proximally in a regular step-like manner so that a line drawn through them was straight and its plane directed distally and slightly medially. The shafts were slender in the middle third and flared out toward the extremities. The middle and proximal phalanges were slender in the distal ends of the shafts, flaring out gently to a wide base. The terminal phalanges were delicate, with no unguicular tubercles (Fig. 19).

The right side of the true pelvis was flattened and the right acetabulum was at a higher level than the left, while the right pubo-ischium was smaller than the left. The symphysis was wider than normal and its edges were irregular. The heads of the femurs were markedly enlarged and the acetabula were wide but shallow. The femoral necks were widened and their inferomesial surface was straight. There was coxa valga. The femoral shafts were slender and slightly osteoporotic (Fig. 20).

In the ankles, the plane of the tibio-astragalar joints was directed slightly laterally (Fig. 21). The calcaneus was short and the posterior inferior tubercles were poorly marked. The 2nd metatarsal was long and the 3rd to the 5th were proportionately shorter, as in the hand. The proximal phalanx of the big toe was short and thick; the other proximal phalanges were somewhat dumbell-shaped. The middle phalanges of the 2nd to the 5th toes were almost square. The distal phalanges were delicate, tapering, and without tufts and that of the big toe was bifid at the tip.

COMMENT

Of the 4 cases reported, 1 was sporadic, while the other 3 occurred in members of a single family—a father and his 2 children. The paternal grandfather in this instance had a clubfoot and a deformed hand and the father's brother had a child with a clubfoot. While this may be explained on the basis of coincidence, it nevertheless leaves open the suggestion that the fault in the parental germ-plasm need not necessarily be specific for this complex skeletal abnormality but may, in frustrated forms, find expression in lesser, more localized abnormalities. The entire skeleton in these patients appeared slightly osteoporotic. The long bones were delicately formed and slender at the shafts and flared out gently toward the extremities.

Retarded ossification is common in cleidocranial dysostosis. The degree of ossification, however, need not be directly proportional to the patient's age. This is seen in Case III, in which ossification at four years of age was less advanced than in Case I at sixteen months.

The typical shape of the skull in the anteroposterior view is that of an inverted pear. This shape apparently takes time to develop, as it was not present in Case II at three months of age but became recognizable at nine and a half months.

Aside from brachycephaly, our patients showed a large cranium out of proportion to the face and to the body as a whole. The anatomico-pathological basis for this is not clear. The prominent frontal and parietal eminences may, to some extent, be explained as compensatory for a comparatively narrow base of the skull. The clinical observations and the radiological appearance on plain films make one think of hydrocephalus and other space-taking lesions. However, although a rare case of syringomyelia or inflammatory or hemorrhagic lesion of the brain has been reported, the vast majority of patients have been neurologically normal.

In all of our cases there was persistence of the metopic suture in the vertical portion of the frontal bone and with wide separation in the upper part. Case III showed a slight hypertelorism associated with epicanthus. With this there was a widening of the nasal process of the frontal bone, through which the metopic suture passed.

None of the 4 patients showed ossification of the nasal bones. These appear to have been replaced functionally by enlargement of the nasal process of the frontal bone. The anterior nasal spine of the superior maxilla was unusually prominent

in Case IV, a common occurrence in this abnormality.

Pneumatization of the paranasal sinuses was poor; the frontals and sphenoidals were absent, the maxillaries were small. Mastoid pneumatization was diploic.

The middle fossa of the skull is short in cleidocranial dysostosis, due to shortness of the body of the sphenoid. The sella is poorly visualized. The greater wings of the sphenoid and the squamous portions of the temporals ossify late.

Failure of union of bones formed from more than one ossification center is characteristic of the condition. In the skull this is seen in absent, late, or incomplete fusion of the two halves of the body of the mandible, of the frontal bone, and of the zygomatic arches.

The deciduous teeth as seen clinically and radiologically in Cases I to III appeared normal. The permanent teeth in Case IV, however, showed typical late eruption, impaction, and malocclusion.

The spina bifida occulta in the cervical and dorsal regions in Case IV, as well as the dorsal scoliosis, are quite common. In addition attention is drawn to the flattened vertebral bodies.

The clavicular defects are pathognomonic. They vary from complete absence of both clavicles (10 per cent of cases according to Soule) to a small defect in one clavicle, as in Case IV. The variety of clavicular defects was explained by Fawcett (4) on an embryological basis. He found that the clavicle develops from two precartilaginous ridges already present in the fifth week of fetal life. Ossification begins separately in each portion, and later the two portions fuse with each other across a membranous bridge which develops between them. Failure of any of these embryological processes will result in a corresponding defect in the clavicle.

In 3 of our cases there was no ossified coracoid process of the scapula and in 1 case the supraspinous fossae were not evident. Two patients (Cases III and IV) showed medial deviation of the forearm clinically. In the latter case this was found to be due to a proximal position of the head of the radius and a medial curving of the shaft of the ulna.

Although retarded ossification is common in cleidocranial dysostosis, accelerated ossification was seen in Case II in the olecranon at three months and in the phalangeal epiphyses at nine and a half months. This was associated with ossification in the carpal bones which, if not definitely delayed, was at least within the lower limits of the normal.

The shape of the hand is fairly characteristic. The metacarpals are long, particularly the 2nd. The heads of the 3rd, 4th, and 5th recede proximally from that of the 2nd in a regular, step-like manner. The shafts of the metacarpals and phalanges are slender, flaring out to their extremities. There is a tendency to the formation of pseudo-epiphyses of the metacarpals. Köhler (5) regards these as evidence of retardation of skeletal growth due to endocrine insufficiency occurring early in development. While this may be true in other conditions, it does not seem to apply here since accelerated and delayed ossification were seen involving different bones in the same patient. Small terminal tubercles or their absence are characteristic.

In the pelvis there is marked widening at the pubic symphysis and at the acetabula due to retarded ossification, and formation of the pubic and ischial rami is delayed. In addition, dysplasia of the head and neck of the femur was seen in the course of development in our first three cases and occurred as a final result in Case IV.

The ankles in Case IV showed an unusual obliquity of the tibio-astragalar joints, an appearance somewhat similar to that in the elbow joints. The calcaneus was shortened in this patient. In addition the metatarsals appeared long and the arrangement of their heads was similar to that in the metacarpals. The terminal tubercles were small, absent, or bifid. The basal epiphyses of the phalanges may be conical (6), an appearance that is not uncommon in other conditions.

SUMMARY

Cleidocranial dysostosis is a congenital abnormality of the skeletal system involving particularly bone of membranous origin. Although the pathognomonic changes are found in the skull and clavicle and to a lesser extent in the pelvis, the entire skeleton is affected to a greater or less degree. Failure of normal fusion of bones or abnormal fusion may occur. Delayed ossification is common but ossification may be accelerated. Four new cases are reported.

NOTE: Data on ossification were obtained from the ossification chart of Paul C. Hodges (University of Chicago, 1933); the ossification chart of J. D. Camp and E. I. L. Cilley, reprinted in Golden's *Diagnostic Roentgenology* (Thomas Nelson & Sons, 1941); Köhler's *Roentgenology* (see references below); Mitchell-Nelson *Textbook of Pediatrics*, 5th edition (W. B. Saunders Co., 1950); and standard texts on anatomy.

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SUMARIO

Disostosis Cleidocraneal, con Presentación de Cuatro Casos

La disostosis cleidocraneal es una anomalía congénita del aparato esquelético, que afecta en particular el hueso de origen membranoso. Aunque las alteraciones patognomónicas radican en el cráneo y la clavícula, y en menor grado en la pelvis, todo el esqueleto se afecta más o menos intensamente. Puede haber falta de la fusión normal de los huesos o fusión anormal. La osificación retardada es frecuente, pero puede haber también aceleración de la misma. Preséntanse 4 casos.

Peptic Ulcers in Children

With Report of Four Cases[1]

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PEPTIC ULCERATION in childhood was once thought to be relatively infrequent. This concept has changed, however, as a result of papers published in various parts of the world during the past fifteen years describing ulcers in the gastrointestinal tract of children. The number of chronic ulcerations of the stomach and duodenum is not nearly so great as the apparent total number of ulcers reported in these parts of the gastrointestinal tract. The great majority of peptic ulcers occurring in the first months of life are acute. Chronic ulcers are more common after the first year. Our definition of a chronic ulcer is one in which symptoms have been present for two months or more, a niche is demonstrable roentgenographically, and a trial at medical therapy has produced partial or complete amelioration of symptoms.

Location and Relative Incidence of Ulcers: The relative proportion of duodenal to gastric ulcers as given in different reports varies. Bird, Limper, and Mayer recorded a three to one ratio. Their series, like others, included acute ulcerations of infancy. Moore found a ratio of seven to one, Gillespie and Bliss of five to one, and Cardemil, Oyarce, and Neira of four to one. Our figures are three duodenal ulcers to one gastric ulcer. These ratios are probably too small. Alexander alone discovered 30 duodenal ulcers in 254 routine examinations in children.

Chronic gastric ulcers in children are uncommon. Forty-five cases have been reported between the ages of three months and fifteen years (Table I). The three-year-old patient in our series is the forty-sixth in this age group and the tenth less than six years old. The majority of duodenal ulcers occur on the posterior wall. Gastric ulcers are found most often in the pylorus; next, in the mid part of the stomach.

Etiology: The etiology of peptic ulcers is unknown. Most authors dismiss the adult factor of emotional trauma as unimportant in the child. Significantly, however, all of our patients had emotional difficulties and 3 had problems serious enough to require psychotherapy for the child or its parents.

Symptoms and Signs: The younger the child the more obscure the signs and symptoms. In the older child, conversely, the symptoms more closely resemble those in the adult. In our 4 patients abdominal pain was the presenting complaint. Abdominal pain and tenderness may closely simulate appendicitis, first appearing in the epigastrium and then migrating to the right lower quadrant. Other signs are tarry stools, vomiting, and nausea.

Differential Diagnosis: Other pathological abdominal conditions must be considered in the differential diagnosis, including mesenteric adenitis, appendicitis, volvulus, intussusception, and acute pyelonephritis. Of greatest diagnostic value is the realization that peptic ulcers do occur in infants and children.

Complications: Perforation heads the list of complications. Fifteen of the 46 cases of chronic gastric ulcer in children have perforated. Hemorrhage and pyloric stricture are other serious sequelae. The

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TABLE I: RECORDED CASES OF CHRONIC GASTRIC ULCER IN CHILDREN FROM THREE MONTHS TO FIFTEEN YEARS

Author	Year Reported	No. of Cases	Age	Sex	Ulcer Site	Diagnosis	Treatment
Rufz	1843	1	13	F	Lesser curvature	Autopsy	None
Verliac	1865	1	14	M	Lesser curvature	Autopsy	None
Bechtold	1904	1	5	F	Greater curvature	Autopsy	None
Robinson	1905	1	14	M	Lesser curvature Multiple ulcers	Autopsy	None
Lund	1909	1	8	M	Antrum	Surgery	Surgical
Loeber	1909	1	3	F	Lesser curvature	X-ray	Medical
vonCackovicz	1912	2	14	M	Antrum	Surgery	Surgical
			13	F	Lesser curvature	Surgery	Surgical
Theile	1919	1	13	F	Lesser curvature	Surgery	Surgical
Sanjek	1920	1	12	F	Pylorus	Surgery	Surgical
Carro	1922	1	8	F	Pylorus	Surgery	Surgical
Norrlin	1923	1	7	F	Pylorus	Surgery	Surgical
Proctor	1925	1	14	M	Lesser curvature	X-ray	Surgical
Weber	1925	2	15	M	Lesser curvature Greater curvature	Surgery	Surgical
			12	M	Prepyloric	Surgery	Surgical
Paus	1926	2	14	M	Antrum	Surgery	Surgical
			9	M	Pylorus	Surgery	Surgical
Robinson	1927	1	12	M	Anterior wall	Surgery	Surgical
Nixon and Fraser	1928	1	3 mo.	F	Cardia	Autopsy	None
Blechmann	1932	1	10 mo.	M	Pylorus	X-ray	Medical
Oldfield	1932	1	13	M	Posterior wall	X-ray	Medical
Jankelson	1932	2	12	M	Lesser curvature	X-ray	Medical
			12	F	Antrum	X-ray	Medical
Foshee	1932	1	13	M	Posterior wall	X-ray	Surgical
Olper	1933	1	11	M	Pylorus	X-ray	Surgical
Sainz de los Terreros and Pérez Moreno	1934	1	5 mo.	M	Antrum	X-ray	Medical
Rocher	1934	1	8	M	Pylorus	X-ray	Surgical
Micheli	1934	2	13	F	Pylorus	X-ray	Surgical
			12	M	Pylorus	X-ray	Surgical
Toro	1937	2	10	F	Pylorus	Surgery	Surgical
			11	M	Pylorus	X-ray	Surgical
Bertrand *et al.*	1937	1	12	F	Pylorus	X-ray	Surgical
Webster	1938	1	4 mo.	M	Pylorus	Autopsy	None
Colson *et al.*	1938	1	14	M	Antrum	Surgery	Surgical
Burdick	1940	2	6	F	Lesser curvature	Autopsy	None
			10	F	Lesser curvature, Pylorus	X-ray	Medical
Moore	1941	1	11	F	Lesser curvature	X-ray	Medical
Logan and Walters	1941	1	12	F	Lesser curvature	X-ray	Surgical
Kraemer and Townsend	1942	1	5	M	Posterior wall, media	X-ray	Medical
Ingram	1950	1	11	M	Posterior wall, lesser curvature	X-ray	Medical
Martin and Saunders	1950	1	6	M	Lesser curvature, Prepylorus	X-ray	Medical
Motsay and Allen	1950	1	2	M	Antrum	X-ray	Medical
Cardemil *et al.*	1950	1	7	?	Anterior wall, media	X-ray	Medical
Goldsberry	1951	1	5	M	Antrum, lesser curvature	X-ray	Medical
Gillespie and Bliss	1951	1	9	M	Lesser curvature	X-ray	Medical
Aye	1953	1	3	M	Pylorus	X-ray	Medical

number of deaths from chronic duodenal ulcer is unknown but Table II lists all the known deaths from chronic gastric ulcer. The last 2 fatal cases have been in infants less than one year old.

TABLE II: DEATHS FROM CHRONIC GASTRIC ULCER

Author	Year	Age	Sex	Cause of Death
Rufz	1843	13	F	Perforation
Verliac	1865	14	M	Perforation
Bechtold	1904	5	F	Perforation
Robinson	1905	14	M	Multiple ulceration
Nixon and Fraser	1928	3 mo.	F	Hemorrhage
Burdick	1940	6 mo.	F	Hemorrhage

CASE REPORTS

The following are the case reports of our 4 patients.

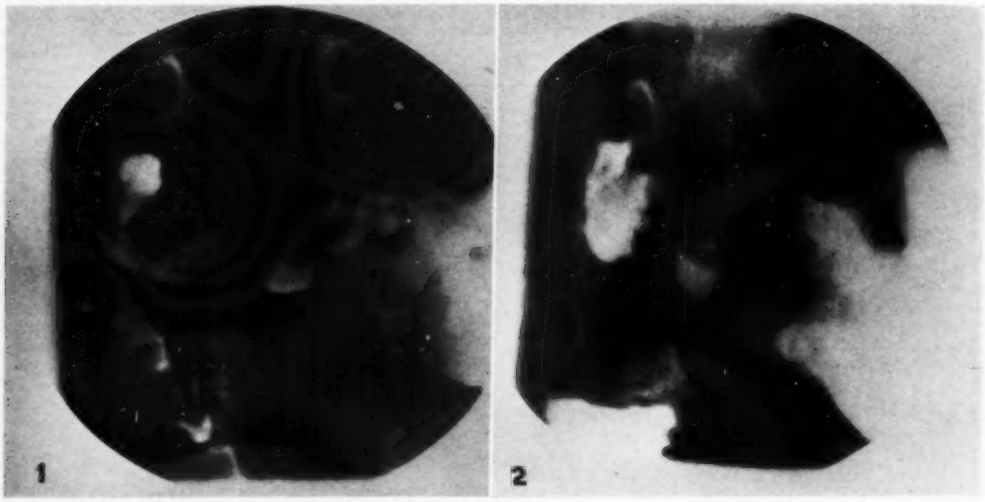

Fig. 1. Case I. Pyloric ulcer on the lesser curvature with an incisura opposite it.
Fig. 2. Case I. Deformity of pylorus without demonstrable crater one month after initial examination.

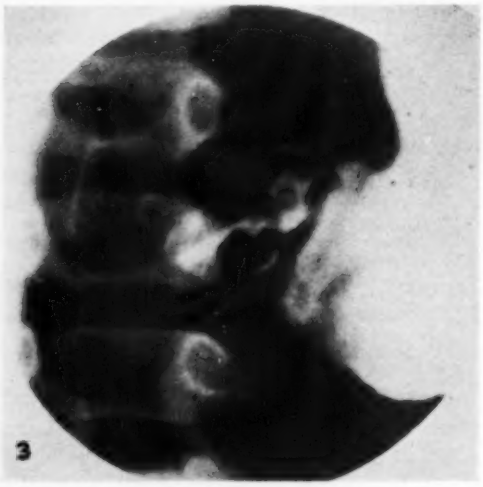

Fig. 3. Case I. Recurrence of ulcer in pylorus six months after initial examination.

CASE I: S. S., a 3-year-old Negro male, was seen in the Pediatrics Out-Patient Department of Evanston Hospital on Sept. 27, with a stomach-ache of three days duration. The pain was not associated with fever, cough, coryza, nausea, or vomiting. Bowel movements occurred daily, and the stools were normal in color, size, and consistency. The preceding year, in November, the child had had a *Giardia lamblia* infestation which had been treated with a course of Atabrine. The diarrhea incident to the parasitism had cleared following therapy and the patient had been asymptomatic until his present illness. Growth and development had been normal. The mother was living and well, as were two siblings.

Physical examination disclosed an apparently healthy child, who appeared alert, co-operative, and in no acute distress. There was no abdominal tenderness. A review of systems was essentially negative. A functional apical systolic murmur was present. It was felt by the examining physician that the complaint represented nothing of significance.

The following day, however, the child returned to the clinic complaining of epigastric pain which was unrelated to ingestion of food and unaccompanied by vomiting, diarrhea, or nausea. Bowel movement had been normal the previous evening. Physical examination again disclosed nothing abnormal. The child was sent home with instructions that his diet be changed to include frequent small feedings of high protein and low fat content and that he be brought back in one week if no improvement were noted.

The following week the patient complained of persisting but less severe pain in the epigastrium which occasionally awakened him at night and was made worse by eating. No bloody or tarry stools had been noted by the mother. A diagnosis was made of possible peptic ulcer or Meckel's diverticulum.

An upper gastrointestinal roentgen examination showed an ulcer crater on the lesser curvature of the pylorus with an incisura on the greater curvature opposite the niche (Fig. 1). The child was placed on an ulcer regime consisting of milk and cream feedings, phenobarbital, and tincture of belladonna, with considerable relief of his symptoms. The pain continued to become less severe and on re-

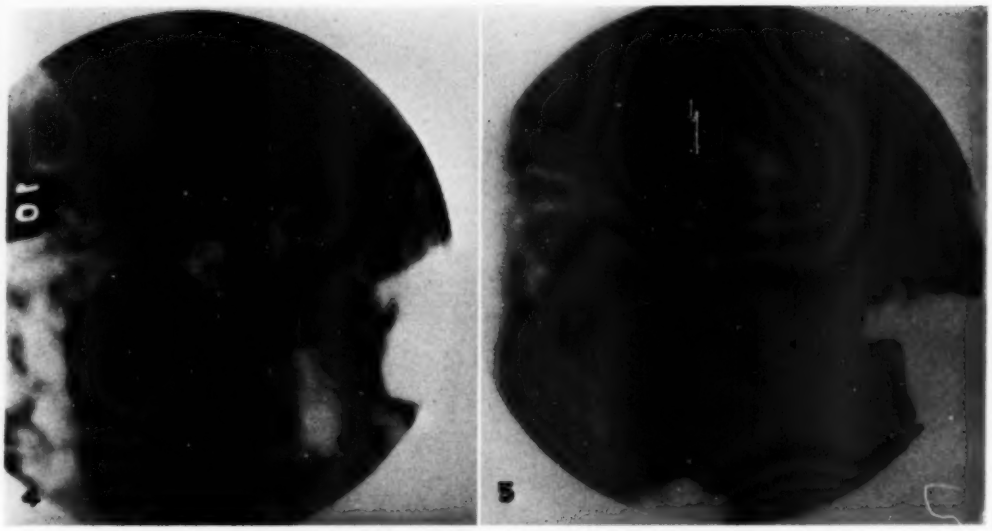

Fig. 4. Case II. Deformed duodenal bulb with an ulcer crater in the center.
Fig. 5. Case II. Crater in center of bulb with incisura.

examination one month later had ceased entirely Roentgenograms at this time were interpreted as showing an incisura but no crater (Fig. 2). Six months from the onset of the original complaints, March 27, x-ray examination was repeated because of recurrence of epigastric pain. An ulcer crater and incisura were again demonstrable (Fig. 3).

This patient was difficult to manage on a diet, and lapses were frequent. The child's mother has shown considerable intolerance of his problem. He is easily upset and according to the parents is hard to manage. Both mother and patient have been receiving some psychiatric therapy.

CASE II: R. H., a 10-year-old white male, entered Evanston Hospital complaining of continuous dull pain in the epigastrium of approximately two months duration. The pain was characterized by acute exacerbations lasting for several minutes. During the first week of his illness the patient had vomited several times and had had a slight diarrhea. Food had brought no relief from pain.

The boy had been well until the present illness. Two weeks prior to admission he had been seen at another hospital with the same complaints, and an upper and lower gastrointestinal roentgen examination had revealed a duodenal ulcer. On this earlier occasion occult blood was present in the stools. The patient had been discharged on an ulcer diet.

About four days prior to entrance to Evanston Hospital, the epigastric pain became more severe and radiated to the right lower and right upper quadrants. On the day of admission the pain had subsided.

The child had had only the usual childhood diseases. Both parents were living and well. There were two siblings, a brother of fifteen and a sister of thirteen, both healthy.

Physical examination showed a tenderness to deep palpation in the epigastrium and right upper and lower quadrants. The stools were free of blood. Urine and blood counts were normal. An upper gastrointestinal study revealed a deformed duodenum with a crater in the center of the bulb (Figs. 4 and 5). The patient improved sufficiently on antispasmodics, antacids, and an ulcer diet to be discharged at the end of ten days. He still had slight lower right quadrant tenderness.

During his hospitalization, the patient was seen by a psychiatrist, who noted that the boy was alert with a good intelligence. He had a strong desire to excel at sports and exceed his older brother in athletic prowess, while at the same time wishing for a large amount of affection. This sort of conflicting situation is often present in peptic ulcer patients according to the examining psychiatrist.

CASE III: M. W., a 4-year-old Negro male, was seen in the Pediatrics Clinic of Evanston Hospital with epigastric pain of two and one-half weeks duration. The pain was severe enough to awaken him at night. When awakened, the boy would crouch at the side of the bed and hold his abdomen. The pain would persist until morning but did not reappear during the day time.

The child had experienced an episode of diarrhea with fever two years prior to his present illness. There had been a convulsive seizure at the age of two, about which nothing further was known. The mother and father were both living and well. There were five siblings, all well.

The physical examination was negative aside

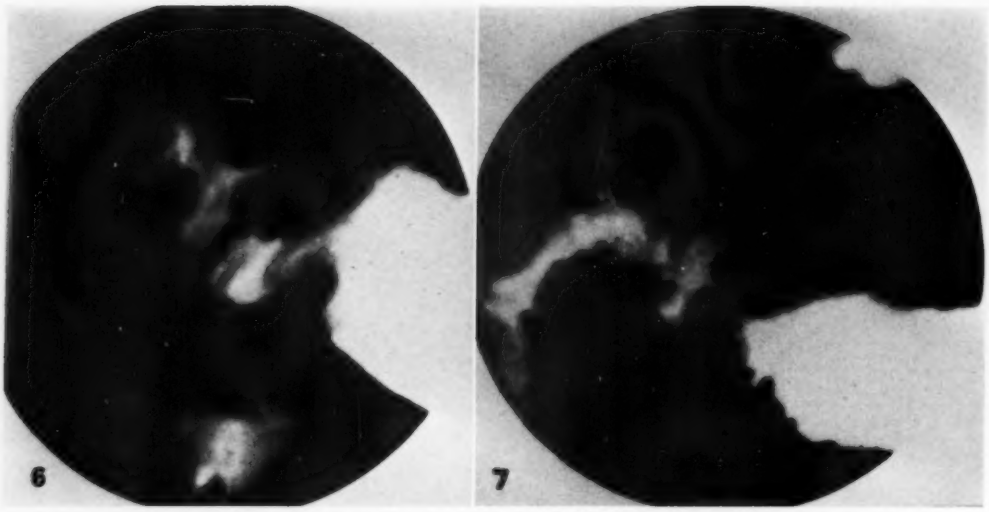

Fig. 6. Case III. Deformed duodenal bulb with ulcer crater.
Fig. 7. Case III. Decrease in size of ulcer and deformity two months after initial examination.

from slight tenderness to deep palpation in the epigastrium. Blood and urine examinations were normal. The child was sent home with instructions to try a prescribed diet of milk and cream and return in one week. He was brought back late in the afternoon of the same day, however, complaining of severe pain in the epigastrium. There was tenderness to deep palpation in the epigastrium, but no abdominal rigidity or rebound tenderness. The lungs were clear; the temperature was normal. An upper gastrointestinal examination the following morning showed a deformed duodenal bulb with an ulcer crater (Fig. 6). The usual medical therapy for ulcer was followed by marked relief of symptoms. X-ray examination two months later showed a decrease in the deformity and size of the crater (Fig. 7).

Psychiatric examination was done because of the mother's request and showed the child to be demanding and unco-operative at home. It was also revealed that the father was very demanding of the mother and resented the children. Psychotherapy and guidance for the child, an emotionally unstable elder brother, and the mother has resulted in some improvement in the child's attitude.

CASE IV: D. L., a 4-year-old white boy, had an onset of sharp, cramp-like epigastric pains in July, with attacks lasting about two to thirty minutes. At first they occurred about once or twice a month but by October were happening twice daily and were much more severe. There were no nausea, vomiting, diarrhea, or tarry stools. A positive Mantoux reaction had been obtained one month prior to the present illness.

The family history and past history were noncontributory.

A new baby had arrived three months before the onset of symptoms, and at about this same time the family had moved to a new home. Both of these conditions the pediatrician felt were conducive to emotional instability in the child.

Physical examination disclosed abdominal tenderness on deep palpation without rebound tenderness or rigidity. No other pathological physical findings were present. An upper gastrointestinal examination showed a deformed duodenal bulb with an ulcer crater (Figs. 8 and 9). The chest film disclosed right-sided calcified hilar lymph nodes.

The patient was placed on an ulcer management with considerable relief of his symptoms. He still has occasional episodes of pain but has gained weight and clinically appears much improved. The parents have refused re-examination of the gastrointestinal tract.

SUMMARY

Peptic ulcers in children are not unusual. Chronic ulcerations are of less frequent occurrence, especially below the age of one year.

The incidence of duodenal ulcers exceeds that of gastric ulcers, with ratios variously given as 3 to 1 to 7 to 1. Chronic gastric ulcer is especially rare in childhood.

Emotional difficulties, commonly considered as an etiologic factor in adults, are frequently overlooked in children.

Four cases of chronic peptic ulcer are reported occurring between the ages of

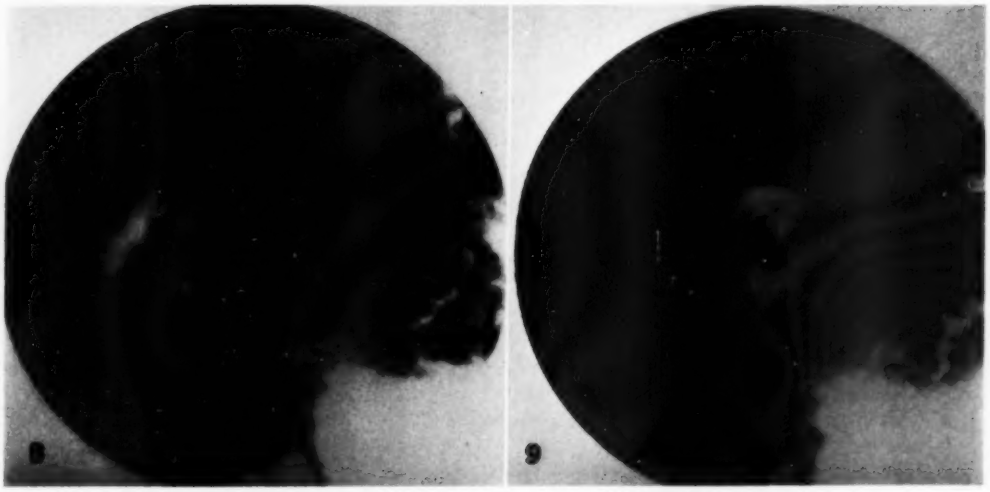

Fig. 8. Case IV. Duodenal ulcer with deformity of bulb.
Fig. 9. Case IV. Deformed bulb and large ulcer crater.

three and ten, 1 gastric and 3 duodenal. In all an emotional factor was present.

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(Para el sumario en español véase la pagina siguiente.)

SUMARIO

Ulceras Pépticas en los Niños, con Presentación de Cuatro Casos

No son raras las úlceras pépticas en los niños. La úlcera crónica es menos frecuente, sobre todo antes de la edad de un año.

La incidencia de úlceras duodenales excede la de las gástricas en una proporción que se hace variar de siete a una a tres a una. Las úlceras gástricas crónicas son en particular raras.

Los trastornos afectivos, considerados comúnmente como factor etiológico en los adultos, se desatienden frecuentemente en la infancia.

Comunícanse 4 casos de úlcera péptica crónica en niños de tres a diez años de edad: 3 duodenales y 1 gástrica. En todos, existía un factor afectivo.

The Angiographic Configuration of Intracerebral Metastatic Tumors[1]

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WITHIN RECENT years attention has repeatedly been called to the significance of cerebral angiography as a means not only of ascertaining the presence and location of an intracranial space-taking lesion, but also of distinguishing between different types of neoplasm. Thus, the specific configurations, in the angiogram, of extracerebral meningioma and of malignant glioma have been described in a series of works, and may now be regarded as well established (Moniz, 19; Lima, 12, 13; Tönnis, 23; Lorenz, 15; Riechert, 20; Engeset, 8; Busch and Christensen, 4; Wickbom, 24; Torkildsen, 22; Miletti, 18; Culbreth *et al.*, 7; Ethelberg, 9).

To the angiographic changes in yet another group of intracranial neoplasms, namely intracerebral metastatic tumors, much less attention has been paid. This is the more notable, since, in view of considerations as to the appropriateness of the surgical measures to which these tumors may lead, we are specially interested in ascertaining their nature prior to operation.

In dealing with the angiographic changes in extracerebral meningiomata, Lorenz (15) also considered those in non-metastatic sarcoma of dural or leptomeningeal origin. As for the vascular changes in the narrow sense, that is to say, the strictly endoneoplastic vascular arrangement, he succeeded in pointing out some features that may be used in the differentiation of sarcomata from meningiomata of the same localization and origin. If, however, the entire vascular configuration is taken into account, it would seem that, as judged from the angiograms, there is so striking a conformity between these extracerebral neoplasms as to lead to no difficulties in the differentiation of malignant growths originating in the osseous structures or the coverings of the brain from those within the brain itself, that is malignant gliomata, malignant papillomata, and metastatic tumors.

Primary intracranial melanomata, as described by Christensen (5), have probably to be classified with Lorenz's sarcomata. Although, as far as we are aware, cerebral angiography has not been reported in cases of this type, it should be recalled that the primary melanomata on record originate from the coverings of the brain, and that the brain itself is not usually invaded.

The angiographic changes in intracerebral metastatic tumors have been dealt with, among others, by Riechert (20), List and Hodges (14), Green and Arana (10), and Wickbom (24). Riechert has only touched upon the problem. List and Hodges and Green and Arana take the view that carcinomatous metastases have the same appearance in the angiogram as glioblastomata. Wickbom describes certain circumscribed abnormal vascular arrangements in about half of his series of 24 intracerebral metastatic tumors. The abnormal vascularization in the narrow sense only has been considered. These changes have been compared with certain definite angiographic types of glioblastoma and of meningioma. It would seem, however, that in confining our consideration to circulation within the neoplasm alone, we are led, as were Wickbom and the above-mentioned writers, to morphological similarities between different types of neoplasm rather than to what may be regarded as our main purpose, namely,

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dissimilarities useful in practice as a means of differentiation.

A recent attempt by Miletti (18) to differentiate metastatic tumors from other types on the sole basis of the angiogram met with complete failure.

There is another point to be noticed. In the discussion arising in conjunction with intracerebral metastatic tumors, we are usually faced with a problem in classification and terminology which, if ignored, may lead to unwarranted complications. It has been customary for many years to distinguish intracerebral metastases of sarcomatous origin from those of carcinomatous origin. The former group consists in the main of the so-called melanosarcomata. Only within recent years has a question arisen as to the appropriateness of conceiving all types of melanoma as sarcomatous in nature. Whatever the origin and final localization of the melanin may be, the view that the true neoplastic element of these highly malignant growths is of ectodermal origin appears to gain ground. This seems to be true at least in so far as concerns metastases from cutaneous nevi, and since this is the type found within the brain, it would seem natural to class them as carcinomata. This view may probably bear on the attempt made by Wickbom to set up, however cautiously, two distinct types of angiographic arrangements in intracerebral metastatic tumors. The one—the sarcomatous type—results in changes, according to Wickbom, similar to those seen in certain glioblastomata, while in the other—the carcinomatous type—the findings are equivalent to those in meningiomata. Now there may well be a difference in the angiograms of these types of metastatic tumor, but as yet this has not been demonstrated convincingly, and the possibility cannot be ignored that any such subdivision is rooted rather in an untenable terminology and classification than in observed facts.

THE PRESENT MATERIAL

We have confined our considerations to supratentorial intracerebral metastases, since in subtentorial tumors angiography has not been performed routinely.

Of 39 cases of metastatic tumor located in the cerebral hemispheres, and verified in this clinic between April 1943 and May 1952, angiography was performed in 24. In 3 of this number the procedure could not be completed satisfactorily, so that there remain 21 cases to be considered. These were all cases of carcinomatous metastases. The nature of the primary growth could be ascertained with certainty, or with so high a degree of probability as to border on certainty, in 19 instances, while in 2 the location and subdivisional type remained unknown. The primary tumor was nevus carcinoma in 6 instances; bronchial carcinoma in 3; renal carcinoma (hypernephroma) in 4; suprarenal carcinoma in 1; adenocarcinoma of the intestinal tract in 2; adenocarcinoma of the breast in 2; and, finally, seminoma in 1 instance.

In all but 2 of the above cases operation was performed. In the remaining cases the tumor was verified at postmortem examination. At operation multiplicity of the metastatic process was found only twice. At autopsy this was disclosed in 3 further cases. In the rest the growth was solitary, or at least appeared so at operation, even though it might have developed from a coalescence of more than one metastatic focus. This cannot, of course, be taken to bear on the real incidence of multiplicity, since only a few postmortem studies were made.

In the majority of this series the tumor affected directly, or was immediately subjacent to, the cortex of the cerebral hemispheres. It must, in this connection, be recalled that an essential part of the cortex of a hemisphere is mesial and basal, so that, as judged from the angiogram, apparently deep tumors may well affect the cortex. Only twice was the growth located deeply in the white matter, in the neighborhood of the basal ganglia. Whether, in reality, these tumors were also cortical or nearly so, that is to say, affecting the cortex deeply at the bottom of the sylvian fissure, could not be ascertained.

As for the regional localizations of the growths, more than half (12 out of 21) affected the parieto-occipital regions of either hemisphere. In 4 instances the tumor was situated in the central and precentral regions. In the only case of multiple metastatic tumor verified in the angiogram, one of the two growths was of occipital location, the other was found deeply in the contralateral central region. In 3 the mesio-basal part of the frontal lobe was the site of the lesion, and in 2 further cases the polar portion of the temporal lobe was affected.

ANGIOGRAPHY

We propose to consider first the neoplastic vascular arrangement in the narrow sense. Next we will be concerned with the relation of this or, in its absence, of the avascular area, to the entire cerebral vascular tree. These features will then be discussed from the point of view of differentiation from other specific tumor configurations, and finally the distinguishing angiographic features of intracerebral metastases will be summarized.

The Endoneoplastic Vascular Configuration: Intracerebral metastatic tumors may manifest themselves in the angiogram as small, almost circular, opaque patches, varying in diameter from a little less than $^1/_2$ inch up to nearly 1 inch. Usually no definite vessels can be distinguished in these patches so that probably the opaqueness reflects a state of precapillary or venular filling. In some instances the patch becomes visible in the late arterial phase of cerebral circulation; in others it may be seen in the cerebral capillary or early venous phase. This was so in about a half of the present series. In the majority of the remaining cases the only visible neoplastic change was a concentrically arranged bundle of delicate arteries. These are probably localized in the periphery of the growth. The central part is completely or nearly avascular, which may be taken to give an indication of the common central necrosis. It should be added, however, that an increase in the number of small vessels has been demonstrated by Christensen (6) in the part of the brain immediately surrounding the neoplasm. Whether these vessels, which have been disclosed microscopically, can be made visible in the angiogram we cannot tell. But it may well be that in some instances of abnormal vascularization at the periphery of the growth we are concerned with these proliferative changes rather than with true neoplastic ones.

In a few instances no endoneoplastic circulation could be seen at all. A mild displacement of neighboring cerebral arteries and the presence of an afferent artery indicated the site of the tumor. This may be bound up with the technical procedure. The most satisfactory results, as has been mentioned above, seem to be obtained when exposure occurs in the final stage of the cerebral arterial phase and in the initial venous phase. The non-filling of endoneoplastic vessels may be ascribed to a too early exposure.

It is apparent, also, from the angiograms that there is a certain definite relationship between the size of the metastatic tumor and its location. Briefly, the nearer the central or rolandic region, the smaller the growth. That, in turn, means that tumors in the "favored" occipitoparietal regions and those of extreme frontal location, as viewed from the rolandic region, are the largest. It is of interest to note that, so far as intracranial meningiomata are concerned, a similar observation has been made by Lund (16). This, as has been assumed by that writer, is probably related to the fact that tumors affecting the cortex (meningiomata), or the cortex together with the subjacent white matter (metastatic tumors), when localized in the central or motor region, give rise to such clinical manifestations as focal epilepsy and localized loss of motor power, so that a diagnosis is usually made at an earlier stage than when the anterior and posterior parts of the hemisphere are involved.

The Exoneoplastic Vascular Configuration: With a few exceptions that will be dealt with below, a cerebral artery or a combination of cerebral arteries could be

readily distinguished, supplying the growth. Although in certain instances there was a definite enlargement of some of the supplying arteries, this was always much less marked than that seen in some cases of meningioma. In the majority, though the vessel was readily distinguishable, no enlargement at all could be seen.

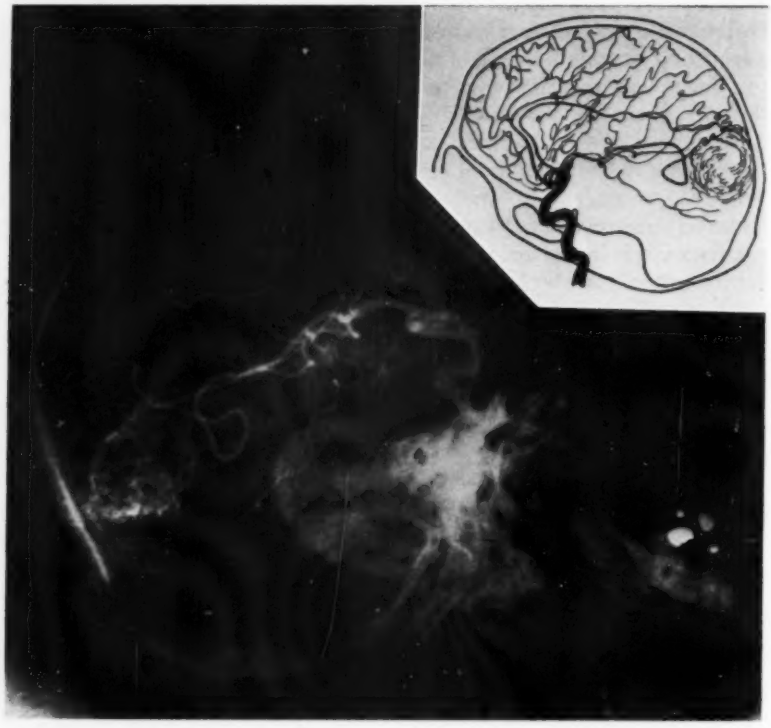

Fig. 1. Cortico-subcortical metastatic tumor (renal carcinoma) in the left occipital lobe. The posterior temporal, from the middle cerebral artery, is the supplying artery. Delicate semicircular endoneoplastic arteries.

Common to the entire series was the fact that the tumor was localized in the terminal territory of a given artery. More than a half of this series, as we said above, were in the parieto-occipital regions, affecting either the convexity or the mesial aspect of the hemisphere, or both at the superior mesial border. In these 12 cases the supplying vessel or vessels were the largest terminal branches of the middle and anterior cerebral arteries. Five were terminal vessels from the middle cerebral (Fig. 1), namely the artery of the angular gyrus in 2, the posterior parietal artery in 1, and the posterior temporal artery in 2. In 5 cases, as judged from the angiograms, the tumor was supplied by the parieto-occipital artery from the anterior cerebral artery in combination with either the posterior parietal artery (Fig. 2), or this together with the artery of the angular gyrus. In 2 of these cases the tumor affected, or was subjacent to, the parietal cortex of the convexity of the hemisphere, and in 3 to the cortex of the mesial aspect of the parieto-occipital region. In only 2 instances of this location was the supplying vessel a branch of the anterior cerebral artery exclusively, namely, the precuneal artery in the one and the parieto-occipital artery in the other.

From the point of view of the pathology of metastases, it is noteworthy that this favored localization, as it were, of meta-

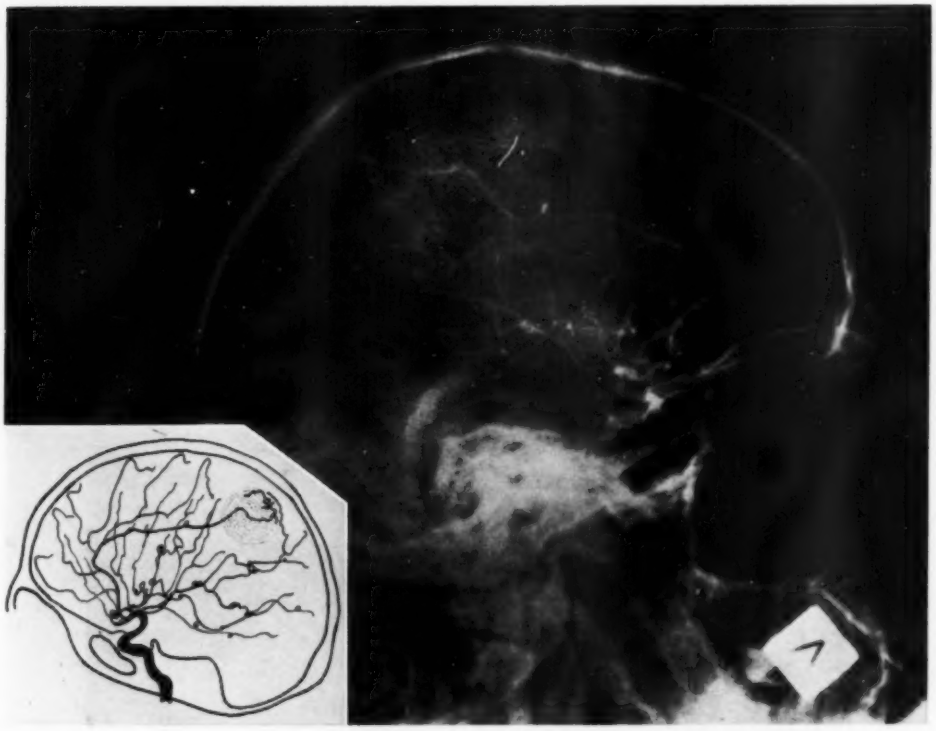

Fig. 2. Metastatic tumor (nevus carcinoma) in the left parietal region immediately subjacent to the cortex, supplied by the precuneal artery from the anterior cerebral, and by the posterior parietal from the middle cerebral. Faint almost circular patch indicating endoneoplastic filling.

static tumors coincides with the territories of the brain supplied by the largest terminal branches of the internal carotid artery. This accords well with the generally accepted route of vascular spread, namely along the arteries. The chance that a neoplastic cell embolus will preferably affect these parts of the brain is large, since through these arteries the greatest amount of blood is carried along at the highest rate. Recently the significance of the vertebral venous system and its connection with the intracranial sinuses (11) in the spread of neoplastic cells has been stressed by Batson (2, 3). This has been further elaborated by Anderson (1). Although this type of metastasis cannot be patently ignored, it is worth noting that in the present cases no changes suggesting a venous metastatic process could be disclosed in the phlebograms.

From the point of view of clinical neurology, the fact that the parieto-occipital territories are favored sites is interesting in that, in the conditions we are considering, perceptive and apperceptive disorders are conspicuously common, such as hemianopsia, visual agnosia, asomatognosia, or disorders of body consciousness (Lunn, 17) or Gerstmann's syndrome. This is probably also related to the chiefly cortical or directly subcortical localizations of the growths and to the fact that these tumors are rapidly destructive.

Delicate ascending branches from the middle cerebral artery were seen as supplying vessels in 3 instances (Fig. 3). Supplying vessels from the anterior cerebral were disclosed in a tumor of the precentral region and in one of mesiobasal frontal location (Fig. 4). In an additional case the tumor also affected the posterior parts

of the mesiobasal frontal cortex, in the vicinity of the posterior perforated area. The growth extended farther back into the territory of the anterior choroidal artery. Under normal circumstances it may be difficult to distinguish this artery in the angiogram, but in this case the vessel, posterior view to pass the neoplastic vessels from both the anterior and middle cerebral arteries.

The only instances in which supplying arteries could not be disclosed were the 2 temporal pole tumors.

It was common to the entire series,

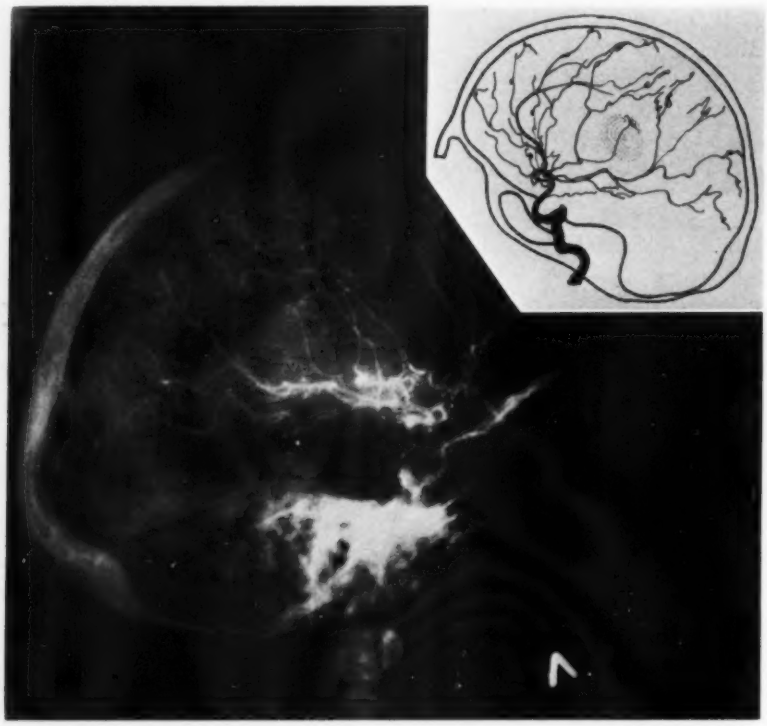

Fig. 3. Cortical metastatic tumor in the posterior part of the left central region (from carcinoma of the breast). Small faint patch of endoneoplastic filling. The supplying artery is one of the posterior ascending branches from the middle cerebral artery. Mild displacement of surrounding vessels.

mildly enlarged, was distinctly visible, branching off from the internal carotid, coursing upward and backward and entering the area of abnormal vascularization. One of the 2 tumors situated deeply in the hemisphere was supplied by one of the central ascending branches from the middle cerebral and also by a few fine branches passing upward to the basal part of the tumor from the central part of the main trunk of the middle cerebral artery. In the other, delicate afferent or feeding arteries were seen in the antero-

also, that the displacement of adjacent cerebral vessels was slight and extremely localized; that is to say, only those portions of the cerebral arteries immediately surrounding the neoplasm were displaced. As judged from the lateral films at least, it was unusual for remote cerebral vessels to be displaced at all. Also in the antero-posterior view the displacement of the anterior cerebral artery under the falx was slight.

Differential Diagnosis: Although the glioblastomata must be our main consid-

eration in differential diagnosis some brief remarks on the differentiation of benign growths from intracerebral metastatic tumors will be appropriate. In meningiomata the endoneoplastic configuration, the localization of the growth within the skull, and its relation to cerebral and extracerebral vessels are so specific (8, 9, 12, 13, 19, 20, 24) as to lead to no difficulty. In the favored sites of metastatic tumors, meningiomata are relatively uncommon, that is to say, in the parieto-occipital regions. This is true both so far as the posterior parasagittal group and the tentorial subdivision of meningiomata are concerned. Even though, in such cases, a marked endoneoplastic vascular pattern need not be disclosed in the angiogram, the displacement of the large, cerebral arterial trunks, more particularly the posterior cerebral artery and its branches, is much more marked; and the participation of vessels from the external carotid system, in the supply of the growth, as may be seen in meningiomata, is never observed in intracerebral metastatic tumors. In some instances of small and medium-sized sphenoidal ridge meningioma no specific vascularization of the tumors can be observed in the angiogram. They merely result in a localized displacement upward of the central portion of the sylvian vessels. Such cases may prove difficult, if not impossible, of differentia-

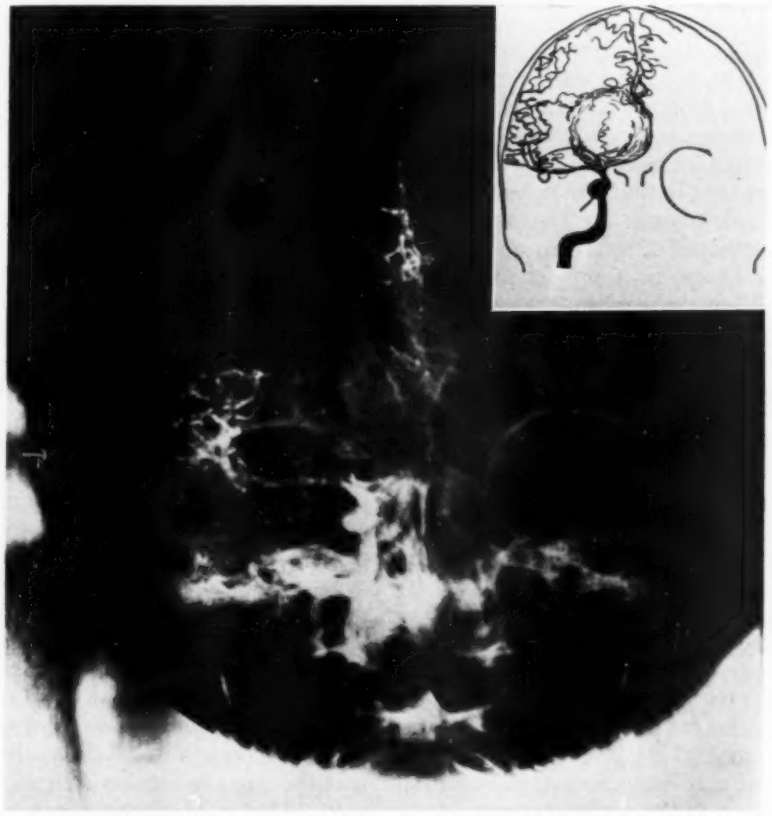

Fig. 4. Cortical metastatic tumor (from bronchial carcinoma) in the mesiobasal parts of the right frontal lobe. Numerous delicate peripheral endoneoplastic arteries. Supplying vessels from the anterior cerebral, and possibly also from the middle cerebral arteries. The main trunk of the anterior cerebral is displaced in the vicinity of the tumor; otherwise no displacement.

tion from metastatic tumors. In this series, as will be recalled, the two neoplasms in this location led to similar angiographic changes, having no demonstrable endoneoplastic vascular configuration.

Benign gliomata usually give rise to a marked displacement of the major cerebral arterial trunks, leaving an almost avascular area behind. Afferent arteries cannot be identified. As distinct from Moniz (19) and Lima (13), we have not been able to demonstrate abnormal vascularization within the tumor area, and we are inclined to agree with Engeset (8) and Culbreth and co-workers (7) that the appearance of endoneoplastic vessels in the angiogram must be conceived of as a sign of incipient malignant change in a previously benign growth. When affecting the temporal lobe, benign gliomata displace the sylvian vessels in their entire course, so as to lead to an exoneoplastic vascular arrangement other than that found in sphenoidal ridge meningioma and temporal pole metastatic tumors.

The angiographic configurations of malignant gliomata (7, 8, 18, 19, 20, 23, 24), more particularly of the angionecrotic glioblastoma (4), are characterized by irregular, tortuous newly formed vessels of varying size, some of which have the appearance of arteriovenous fistulas. The abnormal vessels may be arranged in a gross irregular pattern around a nearly avascular zone (7). But we have found this far more rare in malignant glioma than the occurrence in the peripheral zone of the much smaller metastatic tumors of a circular or semicircular arrangement of delicate arteries, not varying in size. At times a bundle of rectilinear vessels may be seen in the glioma (12, 13, 19). Such configurations, so far as we are aware, have never been observed in metastatic tumors. Moreover, the site of predilection for malignant gliomata is the deep and central parts of the hemisphere, that is to say, far from the cortex. Further, the extension of the area of abnormal vascularization is usually much larger in glioblastomata than in metastatic tumors. Finally, it should be stressed that definitely afferent arteries have not so far been demonstrated in the angiograms of glioblastomata. Displacements of normal cerebral arteries may be seen, but generally they are less marked than those due to benign gliomata. In other instances, in the lateral view there is no gross displacement of cerebral vessels, while in the anteroposterior view the anterior cerebral artery may be markedly displaced under the falx, a displacement usually exceeding that encountered in metastatic growths.

Even though it is unusual for angionecrotic glioblastomata to affect the cortex and the immediately subjacent white matter exclusively, this may occur. If, in such cases, endoneoplastic vascular changes are demonstrable in the angiogram, a differentiation may be difficult, if not impossible. This is also the case with the rare malignant papilloma of the lateral ventricle. This condition may lead to angiographic changes indistinguishable from those in metastatic tumors.

Diagnosis: The distinguishing features in angiograms of intracerebral metastatic tumors may be summarized as follows.

1. If endoneoplastic circulation can be demonstrated, it appears as an almost circular opaque shadow in which no distinct vessel can be identified, or as a bundle of delicate arteries, circular or semicircular in course, surrounding an avascular area (14 cases out of 21). In other cases a small circular avascular area will be found.

2. The area of abnormal vascularization is nearly always localized in the terminal territory of a given cerebral artery (20 of 21); this accords well with the cortical or immediately subcortical location of the growths.

3. One or more delicate supplying arteries from the middle and anterior cerebral arteries could be demonstrated in 15 of 21 cases; in 1 the supplying artery was the anterior choroidal.

4. Although the tumors may be found in any vascular area of the brain, the favored localization is the terminal territories of the largest branches of the internal

carotid—the posterior parietal and the artery of the angular gyrus of the middle cerebral and the parieto-occipital of the anterior cerebral artery—that is to say, the parieto-occipital regions.

5. The displacement of adjacent cerebral arteries is extremely localized and slight.

6. There is no change in the extracerebral vascular configuration.

7. Multiplicity is rarely seen in the angiogram (1 case in this series of 21). If it occurs, it is definite indication of intracerebral metastasis.

On the basis of the angiogram alone, we may in our opinion arrive at a diagnosis both as to localization and as to pathology of intracerebral metastatic tumors in two-thirds to three-fourths of the cases. If, furthermore, the above-mentioned features are found in cases suspected for other reasons of being cerebral carcinoma, the said diagnosis may be considered as certain as the angiographic diagnosis of meningioma. We have, on the other hand, been unable to differentiate, on the sole basis of the angiogram, between the various histologic types of metastatic tumor. Thus, we could not confirm Wickbom's contention that melanomata have an angiographic appearance distinct from other types.

From the point of view of surgical therapy, it is more important that cases of intracerebral metastases from renal carcinoma (hypernephroma) could not be distinguished with certainty from other types. This is the group of metastatic tumors most favorably subjected to surgical treatment (21). Fortunately, from the point of view of diagnosis, they differ from the remainder in that a history of renal disease is usually given. According to Störtebecker (21), the most favorable results of surgical intervention in this group are obtained in cases where the primary growth has been previously removed.

Whether in the remaining types of metastatic tumors surgical treatment should be advocated would seem to be a matter of judgment and temperament on the part of the neurosurgeon. Favorable results cannot be expected. If in the immediate future the above considerations should be confirmed in large series, angiography may become a useful means to avoid futile surgical intervention.

SUMMARY

A series of angiograms of 21 cases of intracerebral metastatic tumor is analyzed. In the majority a small almost circular opaque patch of endoneoplastic circulation could be disclosed; in other instances a circular or semicircular bundle of delicate arteries surrounded an avascular area; in extremely few cases there was no specific configuration. The area of abnormal vascularization was nearly always found in the terminal territory of a given cerebral artery, which usually was the feeding vessel. Although metastatic tumors may affect any vascular territory of the brain, the favored localization was the parieto-occipital regions, that is to say, the areas supplied by the largest terminal branches of the internal carotid artery. The displacement of adjacent cerebral arteries was always mild. Multiplicity was rare; if it occurs, it is a definite indication of intracerebral metastatic processes. The extracerebral vascular system was never involved in the abnormal configurations.

The differentiation from meningioma, benign glioma, and from glioblastoma is discussed.

On the basis of the angiographic configurations we may arrive at a diagnosis, both as to the localization and pathology of intracerebral metastatic tumors in two-thirds to three-fourths of the cases. The various types of metastatic tumor could not, on the sole basis of the angiogram, be differentiated from one another. The group that responds most favorably to surgical treatment, namely metastases from renal carcinoma (hypernephroma), is largely distinguishable from the remainder on certain definite clinical non-neurological criteria. As for the rest, in which no favorable results can be expected, angiography may become a useful means to avoid futile surgical intervention.

NOTE: We wish to express our obligation to Professor R. Malmros for giving us free access to the case records on which this study is based.

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SUMARIO

La Configuración Angiográfica de las Metastasis Intracerebrales de Tumores

Analízase una serie de 20 casos de metástasis intracerebrales de tumores. En la mayoría, se descubrió una pequeña placa opaca, casi circular, de circulación endoneoplásica; en otros casos, un haz circular o semicircular de delicadas arterias que sodeaban una zona avascular; en poquísimos casos, no había configuración específica. La zona de vascularización anormal radicaba casi siempre en el territorio terminal de una arteria cerebral dada, que era habitualmente el vaso de alimentación. Aunque las metástasis tumorosas pueden afectar cualquier parte vascularizada del cerebro, la localización favorita fué en las regiones parieto-occipitales, es decir, en las zonas servidas por las ramas terminales más grandes de la carótida interna. El desplazamiento de las arterias cerebrales adyacentes fué invariablemente ligero. La multiplicidad fué rara; cuando se presenta, constituye una indicación bien definida de procesos metastáticos intracerebrales. El sistema vascular extracerebral no quedó jamás comprendido en las configuraciones anormales.

Discútese la diferenciación del meningioma, del glioma benigno y del glioblastoma.

A base de la configuración angiográfica, cabe formular el diagnóstico de las metástasis intracerebrales de tumores, tanto en cuanto a localización como histopatología, en dos terceras a tres cuartas partes de los casos. A base exclusiva del angiograma, no podrían diferenciarse entre sí las varias formas de metástasis.

Calcification of the Left Auricle[1]

SAMUEL D. HEMLEY, M.D., AARON SCHWINGER, M.D., and LEO A. HARRINGTON, M.D., F.A.C.R.[2]

DURING THE past three years, considerable interest has been manifested in the roentgen diagnosis of calcification of the left auricle. Although only 19 cases have been recorded in the world literature, with a few additional scattered case reports in standard texts, it is our belief that this pathologic process is far more common than has been suggested (1–4)[3]. The purpose of this paper is to present two cases, with material which was studied during the training period of two of the authors, and to demonstrate the additional value of angiocardiography as a diagnostic tool in this condition.

In all reported cases, a clinical or pathologic diagnosis of rheumatic heart disease was made. It was the original work of MacCallum (5, 6) which makes the pathologic anatomy so clear. He described a marked thickening of the wall of the left auricle above the base of the more posterior leaflet of the mitral valve. This is part of the general process of infiltration of the endocardium and subendocardium by inflammatory cells and Aschoff bodies. Ultimately, edema and necrosis make their appearance (7).

More recent studies on the changes in the left auricle in rheumatic heart disease showed 24 of 178 auricles or their appendages (13 per cent) to contain thrombi (8). In no instance was a thrombus found in the right auricle, nor was the right auricle ever more involved pathologically than the left. In 4 hearts the deposits of calcium within the endocardium of the left auricle were conclusively visualized microscopically. This finding, however, is exceedingly rare on gross material. Auricular thrombosis was far more common in cases of auricular fibrillation.

Although calcium can be deposited in many sites when associated with overdosage of vitamin D or abnormal calcium metabolism, this was not the case in any of the reviewed material (9). All cases were accompained by auricular fibrillation. Sosman (10) states that endocardial calcification can be found opposite a septal defect where the abnormal current strikes the endocardial surface. The location in such a case may be of diagnostic aid.

There are no clinical findings that may be of assistance in the ultimate diagnosis. With the present expansion of cardiac surgery, however, careful roentgen evaluation is becoming more important. O'-Farrell (11) reports a case which was discovered during the course of an attempted mitral valvulotomy; dense calcification of the left atrium prevented the completion of the operation. Careful examination of the films, in retrospect, revealed the calcifications.

It has been suggested that changes take place within the auricle proper with auricular fibrillation that may in some way be responsible for the deposition of calcium salts (12). This does not appear likely, as these changes have as yet not been reported with auricular fibrillation secondary to cardiac disease other than rheumatic heart disease. It appears more likely that these changes, both fibrillation and calcification, are the result of a long-standing destructive disease process. Almost all patients with left auricular calcification are over forty years of age and pathologically have marked mitral stenosis.

Most cases of left auricular calcification can be diagnosed after viewing a teleroentgenogram of the chest in the postero-anterior projection. A curvilinear calcification will be observed within the area of the left auricle. Overexposed Potter-

[1] Accepted for publication in June 1952.

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[3] A report of 8 additional cases appeared in RADIOLOGY after the present paper had been accepted for publication (Curry, Lehman, and Schmidt: Radiology 60: 559, April 1953).

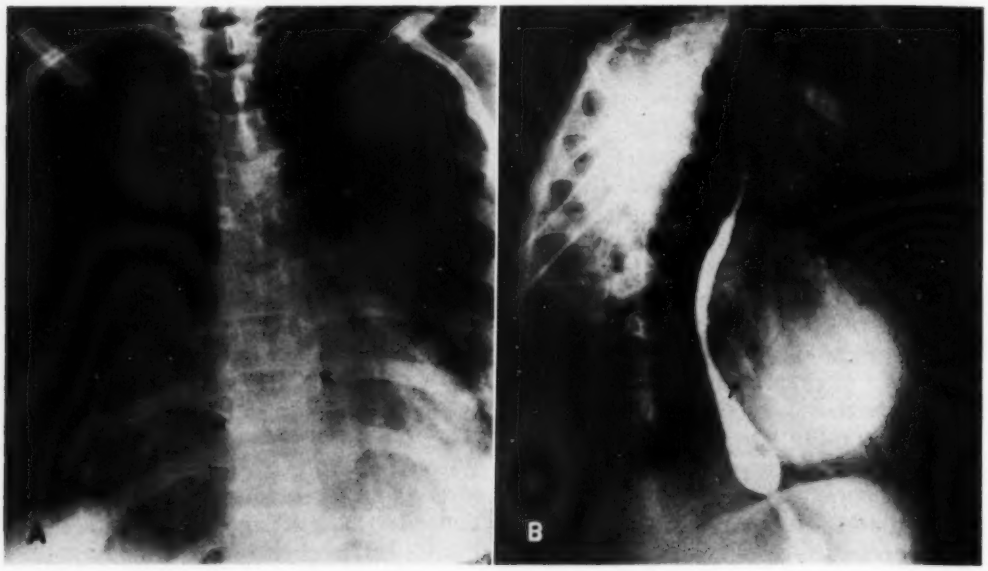

Fig. 1. Case I. A. Postero-anterior projection demonstrating the calcification (outlined by arrows). B. Posterior displacement of the barium-filled esophagus by the calcified left auricle.

Bucky films will more clearly define the confines of the calcifications. In the right anterior oblique view, the left auricle will displace the barium-filled esophagus in the typical fashion, while the left anterior oblique projection may show elevation of the left main bronchus. Kymography may be attempted and, if of diagnostic aid, would yield pulsations opposite to left ventricular pulsations in the calcified area (13). We have found this procedure of no help whatsoever. Two additional procedures, laminagraphy and angiocardiography, are usually unnecessary, but in a troublesome case they may reveal the true site of the pathology; the latter was performed in Case I.

In the differential diagnosis, other cardiac calcifications and those contiguous to the heart must be considered. Coronary arteries are visualized as thin linear streaks. Ventricular aneurysms are located most often at the cardiac apex. Mitral and aortic valvular calcifications can easily be distinguished on roentgenoscopy, being more central in location and having a characteristic motion. Pericardial calcifications are more peripheral and are usually more diffuse than auricular calcification. Ecchinococcus cysts and calcified cardiac tumors are so rare that they will only be mentioned. Hilar lymph nodes and calcified costal cartilages can be excluded on oblique projections.

CASE REPORTS

CASE I: M. M., a 38-year-old Negro female, was admitted complaining of para-umbilical pain, postprandial. Orthopnea and dyspnea had been present for three weeks. Ankle edema and nocturia had not been noticed.

Physical examination showed evidence of cardiac decompensation and rheumatic mitral stenosis. An electrocardiogram revealed right axis deviation and sinus tachycardia; these findings were confirmed on follow-up. Laboratory studies, including sickle-cell preparations, were within normal limits.

Figure 1A and B demonstrates the calcification within the left auricle during routine studies. Figure 2A and B reveals the calcification within the left auricle during angiocardiographic opacification of the right auricle and ventricle.

CASE II: L. M., a 60-year-old white female, was admitted for treatment of mild cardiac decompensation. Past history revealed a previous episode of cardiac failure which had been under control prior to this admission.

Pertinent findings were those of cardiac decompensation. Auricular fibrillation was noted clini-

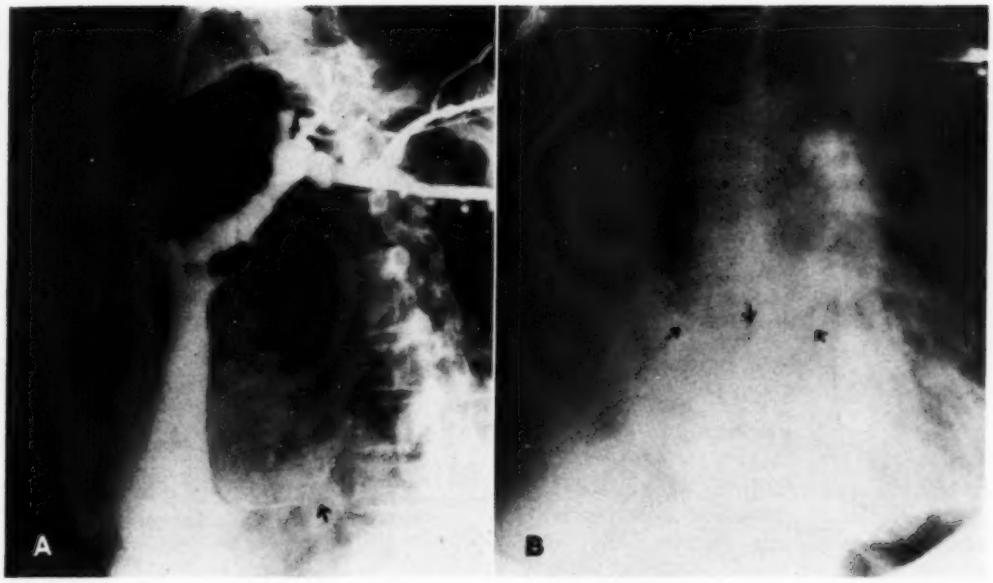

Fig. 2. Case I. A. Opacification of superior vena cava and right auricle during angiocardiography. The confines of the left auricle are outlined by its linear calcifications (arrows). B. Opacification of right ventricle and pulmonary arteries. The calcification of the left auricle is noted in the non-opacified left auricle.

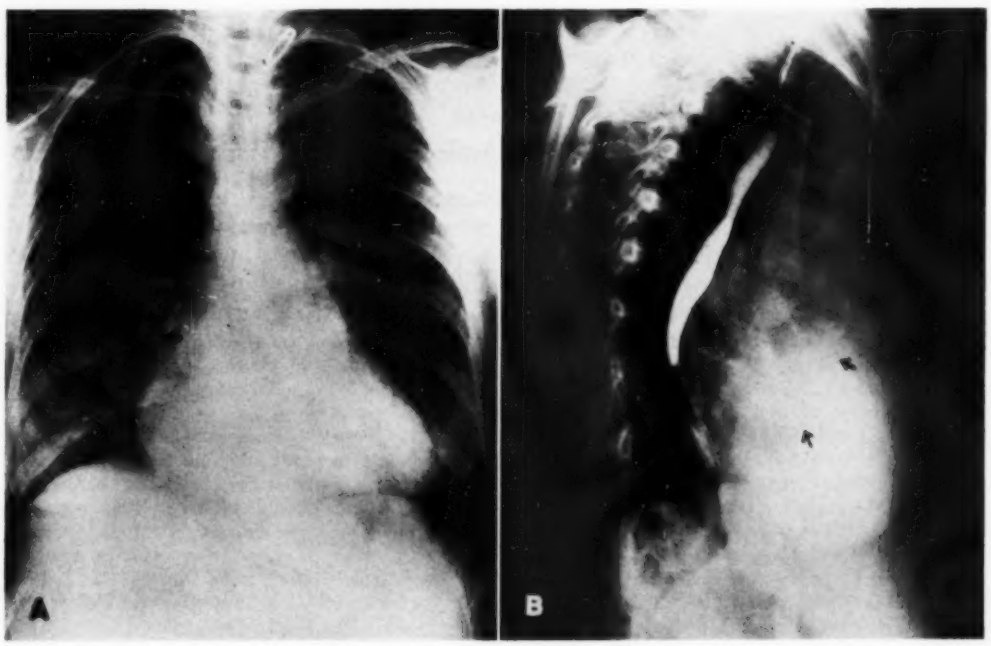

Fig. 3. Case II. A. Routine postero-anterior projection showing the enlarged heart with calcification in the left auricle. B. Barium esophagram, right anterior oblique view, showing posterior displacement of the lower one-third of the esophagus by the enlarged left auricle.

cally and confirmed electrocardiographically. The underlying etiologic basis for the cardiac status was considered to be rheumatic heart disease. Laboratory data were non-contributory. A serologic test for syphilis was negative.

A postero-anterior roentgenogram of the chest showed an enlarged heart with calcification in the left auricle (Fig. 3A). A barium esophagram revealed posterior displacement of the lower one-third of the esophagus by an enlarged calcified left auricle (Fig. 3B).

The patient has been followed in the Outpatient Department for the past two years and remains comfortable on a cardiac regime.

SUMMARY

Two cases of calcification of the left auricle are presented. The clinical and roentgenographic impression was that of rheumatic heart disease. Both patients were living at the time of this report. One patient has at no time shown evidence of auricular fibrillation. Marked involvement of the left auricle with long-standing cardiac disease (rheumatic heart disease) appears to be a prerequisite to ultimate calcification.

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SUMARIO

Calcificación de la Aurícula Izquierda

Preséntanse 2 casos de calcificación de la aurícula izquierda. La impresión creada clínica y roentgenológicamente era de reumatismo cardíaco. Ambos enfermos estaban vivos al hacerse esta comunicación. Uno no ha revelado en ninguna ocasión signos de fibrilación auricular. La invasión acentuada de la aurícula izquierda con afección cardíaca de mucha duración (cardiopatía reumática) parece constituir un *sine qua non* del desarrollo de la calcificación definitiva.

Bilateral Aneurysms of the Subclavian and Axillary Arteries[1]

Report of a Case

S. PAUL PERRY, M.D., and CHARLES W. MASSEY, M.D.

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THE FOLLOWING case of bilateral aneurysms of the subclavian and axillary arteries is unique in the authors' experience, nor were they able to find any similar example in the literature.

CASE REPORT

A white male, 14 years of age on his admission, Feb. 16, 1950, to the cardiovascular service, complained of headaches and blurring of vision of approximately two months duration. He had previously been in good health. The headaches were gradual in onset and bilaterally frontal and supraorbital in position. They had become increasingly severe and frequent and seemed to be aggravated by exertion. The patient stated that just prior to admission he would awaken in the morning with headache, occasionally improving on arising. Blurring of vision had been noted only on reading fine print. There were no other symptoms and the review of systems contributed no further information. There was no history of vertigo, nausea, or vomiting.

The past history revealed an uncomplicated tonsillectomy at seven years of age. There had been occasional enuresis. Urine studies six years earlier were negative, and this complaint apparently subsided.

In 1946, the patient was in a hospital for twelve days for a blood clot said to involve the left forearm. The symptoms were pain, paresthesia, and coldness of the left hand, with no loss of function. The condition was treated with a heat cradle to the arm, and there was no residuum. There was a history of occasional headaches earlier, for which glasses were prescribed in 1948. In December 1949, examination by a school physician revealed a hypertension, and the patient was hospitalized for eleven days from Jan. 15, 1950, for study.

The patient did not use tobacco but drank an occasional glass of wine and took two cups of coffee daily. He made fair grades in high school. Four sisters and three brothers were living and well. His father was fifty-five years of age, with a history of bronchial asthma. His mother was fifty years of age and diabetic.

Physical examination revealed a well developed and well nourished youth of Italian descent. His height was 65 inches and weight 120 pounds. The pulse was 80 and the oral temperature was 99° F. The blood pressure was 138/68 on the right; on the left it was 100/? by palpation, with no pressure reading obtainable by auscultation. The eyegrounds were considered normal. The cardiac apical impulse was forceful. The radial and brachial pulses were strong and normal on the right but markedly diminished on the left. There was a loud bruit and thrill on the right side of the neck and beneath the right clavicle. Blood pressures in the legs were 170/90 right and 160/90 left.

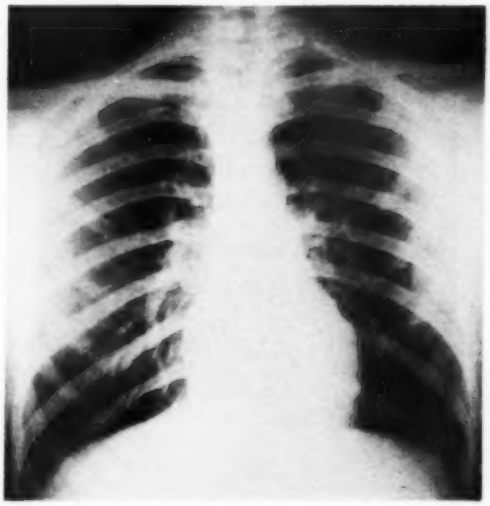

Fig. 1. Regular chest film demonstrating no gross abnormalities.

Laboratory studies were not remarkable. An electrocardiogram and a chest roentgenogram (Fig. 1) were normal. The Kahn test was negative. The urine was acid, negative for albumin and sugar and microscopically, with a specific gravity of 1.020. Hemoglobin was 14 gm., and the red blood cell count 4,340,000, the white cell count 5,650, with 61 per cent polymorphonuclear leukocytes, 37 per cent lymphocytes, and 2 per cent eosinophils.

On chest fluoroscopy, prominent left auricular pulsations and a left hilar dance were noted without evidence of auricular enlargement.

On Feb. 21, 1950, bilateral subclavian arteriograms were obtained. With 18-gauge needles, direct

[1] From the Department of Radiology at the Guthrie Clinic and Robert Packer Hospital, Sayre, Penna. Accepted for publication in June 1952.

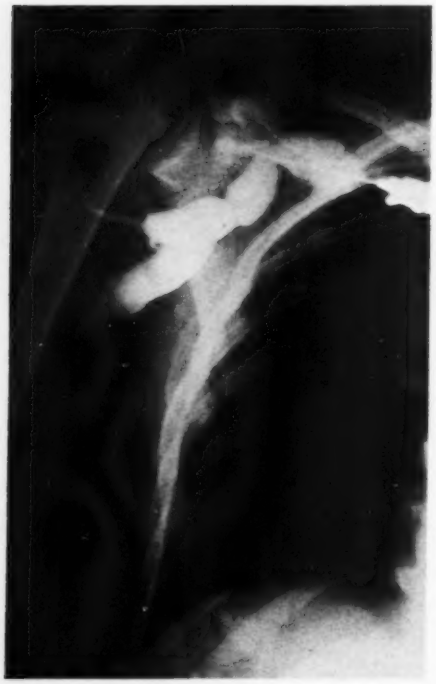

Fig. 2. Film obtained during injection of Diodrast into the *right* subclavian artery, demonstrating the aneurysmal dilatation.

injection of 35 per cent Diodrast was made into the third portion of each subclavian artery by an infraclavicular approach. Two injections of 20 c.c. each were used on the left and a single 20-c.c. injection on the right. The right arteriogram (Fig. 2) revealed marked dilatation of the distal subclavian and axillary arteries while the caliber of the brachial artery was normal. The left arteriogram (Fig. 3) also revealed gross dilatation of the distal subclavian and axillary arteries with absence of the medium for a length of 5 cm. in the region of the proximal end of the brachial artery. This was thought to represent the site of the previous thrombosis. Collateral vessels were visualized.

DISCUSSION

Temple (1) recently reviewed the literature with respect to aneurysms of the first part of the left subclavian artery and presented one case. He particularly stressed the technical problems involved in surgical approach. Aneurysms of other portions of the left subclavian artery were briefly mentioned. With the exception of one syphilitic aneurysm, all these were unilateral traumatic aneurysms from gun-shot wounds or external trauma to the chest.

In 1939, Hill (2) reported a case and reviewed the literature on vascular anomalies of the upper limbs associated with cervical ribs. He stated that while motor and sensory phenomena are usually well rec-

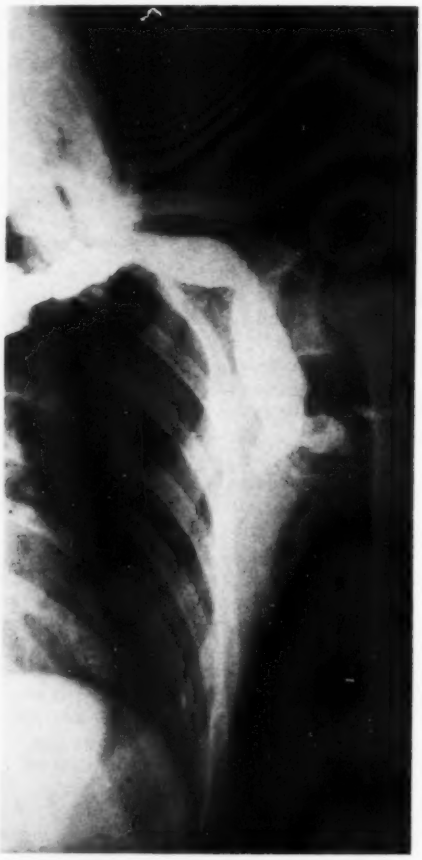

Fig. 3. Film obtained during injection of Diodrast into the *left* subclavian artery, demonstrating the aneurysmal dilatation.

ognized, the effects on the vascular system are often less clearly defined, whether produced by direct pressure on the subclavian artery or indirectly through sympathetic irritation. He mentioned Halsted's review of 525 such cases with 27 instances of aneurysm or dilatation of the subclavian artery distal to the cervical rib unilaterally. Excessive pulsation of the distal artery has been mentioned frequently. Hill referred

also to a case of J. M. Graham with bilateral cervical ribs and aneurysms. All of these cases were symptomatic.

Eden (3) at the same time reported on vascular complications of cervical ribs and first thoracic rib abnormalities. He presented 3 cases and summarized 45 cases from the literature. In only a few of these cases was there definite aneurysmal dilatation of the distal subclavian artery. In these instances, he believed that the artery was weakened by compression between the clavicle and the bony obstruction with dilatation and possible resultant thrombosis and emboli. Of interest in this series were one case of asymptomatic unilateral aneurysm associated with a cervical rib, one case of aneurysm without proved cervical rib but with vascular changes in the hand, and one case of aneurysm with vascular changes in the hand without cervical rib or abnormality of the first thoracic rib.

McGowan and Velinsky (4) have recently discussed costoclavicular compression and its relation to the scalenus anticus and cervical rib syndromes. They think this better explains aneurysm of the subclavian artery just beyond the scalenus anticus muscle and the associated embolic phenomena. All of the cases discussed were symptomatic, with physical findings of this syndrome and without aneurysms.

We believe that the cases of subclavian aneurysm previously reported, of which those cited above are representative, fail to offer an explanation of the present case. The aneurysms in this instance are strikingly symmetrical. There is no cervical rib on either side and no physical finding of this or a related syndrome. The aneurysms are asymptomatic and there is no history of trauma. We have no good explanation for the apparent thrombosis of the left axillary artery but think that the aneurysms are probably due to congenital anomalous development.

SUMMARY

A case of bilateral subclavian and axillary aneurysms has been reported which is believed to represent a congenital anomaly. Diagnosis was established by arteriography, which also demonstrated the site of an old thrombosis.

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SUMARIO

Aneurismas Bilaterales de las Arterias Subclavia y Axilar: Presentación de un Caso

En un niño de catorce años, observáronse aneurismas subclavio y axilar bilaterales. Los aneurismas eran notablemente simétricos. Ni en uno ni otro lado había costilla cervical ni tampoco signos físicos de este o de algún otro síndrome afín. Los aneurismas eran asintomáticos y no había antecedentes de traumatismo. Créese que representan una anomalía congénita. Se estableció el diagnóstico por la arteriografía, que también reveló el asiento de una antigua trombosis.

Kyphoscoliosis: Angiocardiographic Findings[1]

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THE DEFORMITIES of the spine and thoracic cage in kyphoscoliosis are evident by conventional roentgenography. The distortion of the cardiac silhouette is also frequently pronounced, but without the aid of angiocardiography it is difficult to identify specific chambers or vessels. Angiocardiography in several cases of severe kyphoscoliosis clearly revealed the anatomical changes.

In persons with severe kyphoscoliosis, pulmono-cardiac failure usually develops. This condition is a distinct entity, not to be confused with the congenital heart disease often associated with scoliosis. Right heart failure occurs secondary to the pulmonary and cardiac changes brought about by the thoracic deformity.

In kyphoscoliosis, the principal changes in the lungs are areas of compression and emphysema and decreased lung volume due to the misshapen thorax. In addition, probably because of interference with lung drainage due to the distorted bronchi and limitation of costal movement, recurrent pulmonary infections are common. At postmortem examination the typical changes of cor pulmonale, *i.e.*, right ventricular dilatation and hypertrophy and pulmonary artery enlargement, have been reported in 75 per cent of cases of severe kyphoscoliosis (1, 2, 3). It has been suggested that kinking or twisting of the great vessels may also be responsible for certain signs and symptoms (4).

In conventional roentgenography typical changes in the cardiac silhouette have been noted (4). Cardiac displacement to the left is common in right scoliosis. There are often a prominent pulmonary artery segment and lack of prominence of the aortic knob. The variations in the silhouette are many, and in many instances it is not possible to identify clearly the specific mediastinal structures.

ANGIOCARDIOGRAPHIC FINDINGS

Angiocardiographic examination in four patients with severe kyphoscoliosis revealed bizarre cardiovascular configurations which varied from case to case.

As a rule, the cardiovascular structures accommodated to the deformity of the thorax. The cardiac chambers and great vessels were tipped and rotated but not apparently compressed. Decrease in the vertical diameter of the thorax may cause the apex of the heart to be tipped upward and the base depressed. In extreme cases, the heart may lie in an almost horizontal position (Fig. 2). Our cases all exhibited kyphoscoliosis with a convexity to the right (the most frequent type of deformity). This thoracic configuration caused the heart to rotate, so that it resembled the projection usually seen in the right anterior oblique position (Fig. 1). In one case (5) the base of the heart was displaced to the right, and the apex was elevated and pointed to the left. The heart was also rotated to the right anterior oblique position. This caused the left atrium to be displaced to the right in relation to the left ventricle in the frontal projection.

The superior vena cava took the most direct route from the subclavian vein to the right atrium and did not follow the curvature of the spine. In severe right scoliosis it may run to the left of the spine (Fig. 1A).

No kinking or twisting of the main stem pulmonary artery could be identified in our series. The right and left pulmonary arteries and their branches were distorted and conformed to the misshapen lungs. In areas of emphysema, the peripheral

[1] From the Department of Radiology of the New York Hospital-Cornell Medical Center. Accepted for publication in August 1952.

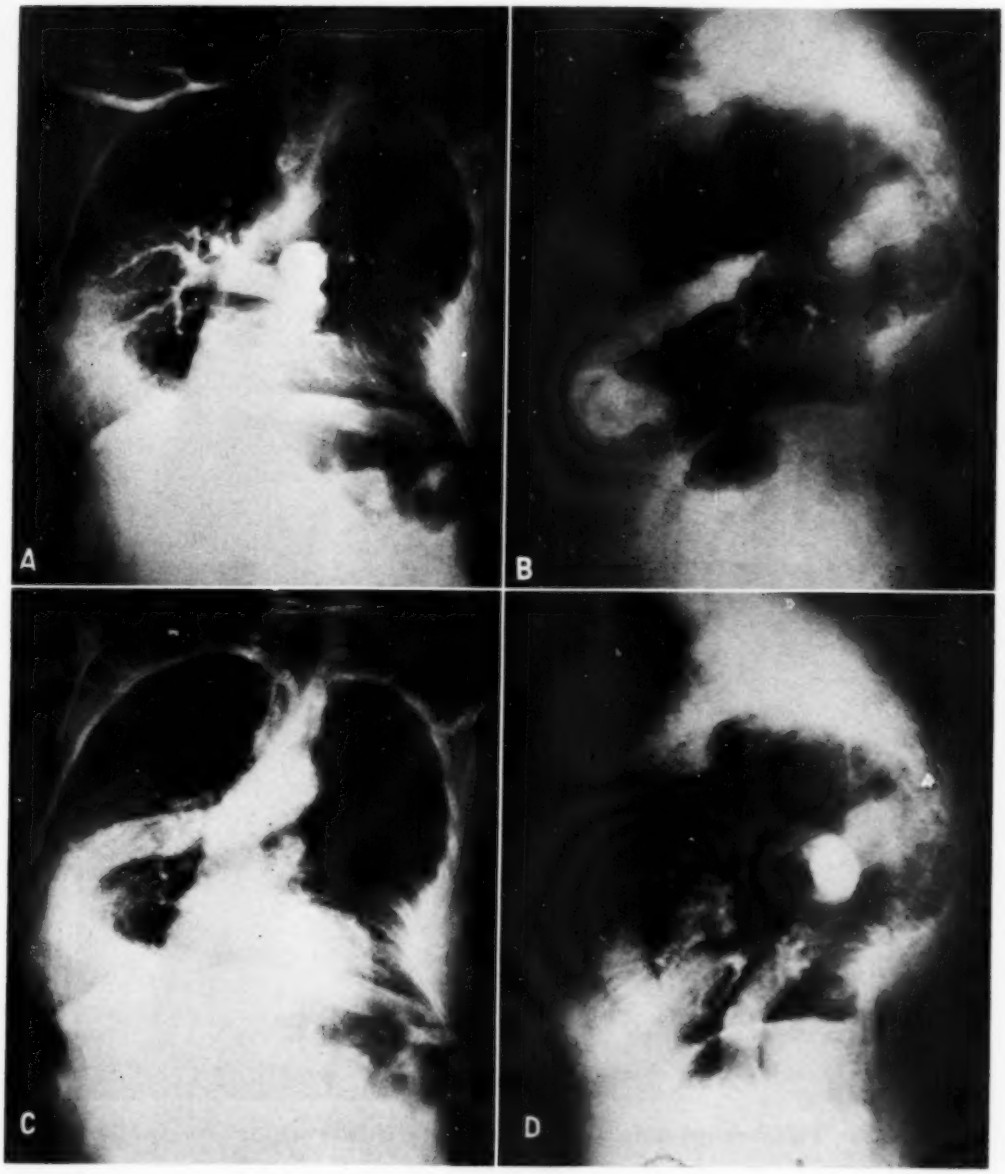

Fig. 1. Seventy-one-year-old female with kyphoscoliosis since the age of eleven. The only complaint was exertional dyspnea for several years. Examination revealed emphysema in addition to kyphoscoliosis. Electrocardiogram normal.

A and B. Frontal and lateral angiocardiograms, right heart opacified. Heart slightly rotated to right oblique position. Pulmonary artery and branches distorted. C and D. Left heart opacified. Descending aorta markedly displaced, following spine into right thorax.

branches were narrowed and separated, and the blood flow was diminished. In the areas of lung compression, the vessels were crowded together (Fig. 1A and B).

The aorta always closely followed the deformed spine. This led to striking deviations in its course. In right scoliosis, it turned sharply to the right at the arch or

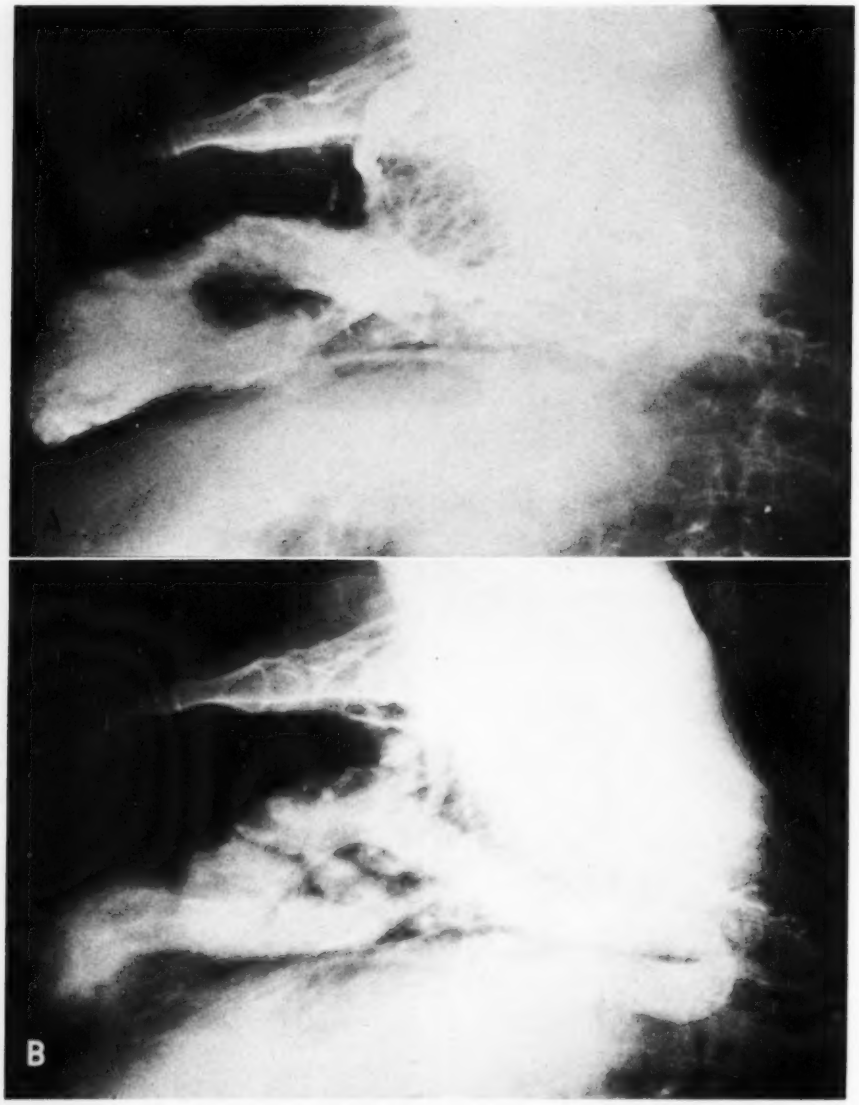

Fig. 2. Thirty-four-year-old male with kyphoscoliosis since childhood; angina for three years; dwarf-like appearance. Electrocardiogram normal.
A. Lateral angiocardiogram, right heart opacified. Decreased vertical diameter of chest results in an almost horizontal position of the heart. Right ventricle enlarged. B. Left heart opacified. Extreme distortion of aorta, which makes a 180-degree bend as it follows the spine.

upper descending aorta, causing a reversal in relationship of the ascending aorta to the descending aorta. Abrupt alterations in the course of the aorta may occur adjacent to sharp bends in the spine (Figs. 1 and 2).

Angiocardiography is limited in the identification of cor pulmonale (5). In many cases, right ventricular enlargement or pulmonary artery dilatation may not be evident, although in cardiac catheterization there is elevation of the right ventricular and pulmonary artery pressures. Estimation of right ventricular size by

angiocardiography is unreliable in the absence of synchronization of the x-ray exposure with the phase of the cardiac cycle. However, gross right ventricular enlargement was evident in one case (Fig. 2A) and two had pulmonary artery enlargement.

ACKNOWLEDGMENT: The authors gratefully acknowledge the co-operation of Dr. Maxwell L. Gelfand, who referred two patients in this study.

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SUMARIO

Cifoscoliosis: Hallazgos Angiográficos

El examen angiográfico de 4 enfermos con cifoscoliosis grave reveló peculiares configuraciones cardiovasculares, que variaban de caso en caso. Por regla general, los tejidos cardiovasculares se acomodaban a la deformidad torácica. Las cavidades cardíacas y los grandes vasos estaban inclinados y rotados, pero no deprimidos aparentemente. La punta del corazón estaba inclinada hacia arriba y tenía la base deprimida. No se descubrió acodadura o torsión del tronco principal de la arteria pulmonar, pero las arterias pulmonares derecha e izquierda y las ramas de éstas se hallaban deformadas, conformándose al desfigurado pulmón. La aorta seguía de cerca al deformado raquis, pero la vena cava superior tomaba la vía más directa desde la vena subclavia a la aurícula derecha.

La angiografía posee valor limitado en la identificación del corazón pulmonar. El cálculo de la hipertrofia del ventrículo derecho por ese medio no resulta fidedigno, de no haber correlación de la exposición a los rayos X con la fase del ciclo cardíaco.

Congenital Hereditary Cranium Bifidum Occultum Frontalis

With a Review of Anatomical Variations in Lower Midsagittal Region of Frontal Bones[1]

RAYMOND J. TERRAFRANCA, M.D. and ALLAN ZELLIS, M.D.

Washington, D. C.

MANY CASES OF cranium bifidum frontalis associated with meningocele and meningo-encephalocele have been described, especially by neurosurgeons. In a review of the literature, we have found few reported cases of cranium bifidum occultum as such, and a survey of these cases revealed that the cranium bifidum was usually associated with craniofacial dysostosis, cleidocranial dysostosis, or abnormalities of the central nervous system. In the cases to be reported here, the cranium bifidum occultum was associated with large parietal foramina and spina bifida occulta. The patients were otherwise normal.

Eckhardt (4), in 1919, reported a case showing a defect of the skull between the bregma and the frontal hairline without herniation of the brain. Associated with this defect were an atypical course of the frontal suture, abnormal configuration of the skull, hypertelorism along with divergent strabismus and horizontal nystagmus, and a gaping mouth producing a stupid and grotesque facies. A defect was also present in the right parietal bone. These findings, apparently, are consistent with craniofacial dysostosis.

Laursen (9), in 1942, reported 2 cases of cranium bifidum occultum. The first was in a nine-year-old girl who had rickets during childhood and had sought treatment for a fracture of the tibia. The neurological examination proved negative. X-ray examination showed a caput quadratum type of skull with a mid-line defect along the whole sagittal region from the root of the nose to an area in the occiput. A brother of the patient was a midget and an imbecile. A sister was a dwarf.

The second of Laursen's patients was a girl not quite two years of age, who was being placed for adoption. She was hospitalized for hydrocephalus. The mother had been treated for syphilis. The child had not grown normally during the first year but grew well thereafter. She was of low intelligence. The skull was wide and asymmetric, the right side being larger than the left. The forehead bulged forward. The frontal and parietal tuberosities were markedly prominent. The form of the skull represented a combination of hydrocephalic and rachitic cranium. A deep depression could be felt in the frontal suture region. The sagittal suture was wide open throughout its entire length.

Caffey (3) in his book describes and illustrates a cranium bifidum occultum in the posterior sagittal region. Pancoast, Pendergrass, and Schaeffer (11) in their text demonstrate a frontal skull defect in a case of cleidocranial dysostosis. Many other cases of cleidocranial dysostosis with cranium bifidum occultum have been reported.

CASE REPORTS

We are reporting 4 cases of cranium occultum frontalis occurring in three generations of a colored family.

A 6-year-old colored girl (Fig. 1) was referred for roentgen examination of the skull for a possible depressed fracture of the frontal bone. She had fallen and suffered a superficial laceration in the mid-line of the forehead. On palpation, no bone resistance was felt in this region.

Roentgenograms (Figs. 2, 3, and 4) of the skull and cervical spine revealed a large symmetrical shield-shaped defect measuring 5.0 × 3.5 cm. in the lower mid-portion of the frontal bone. There was complete absence of bone in this area. The margins

[1] From the Department of Radiology, Gallinger Municipal Hospital, Washington, D. C. Accepted for publication in August 1952.

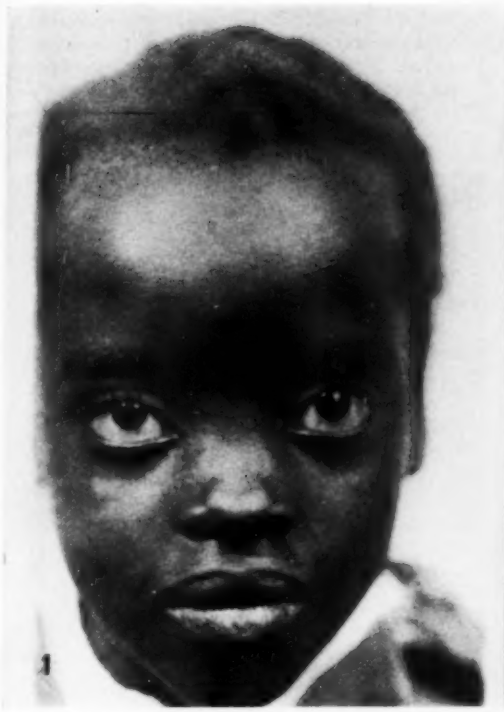
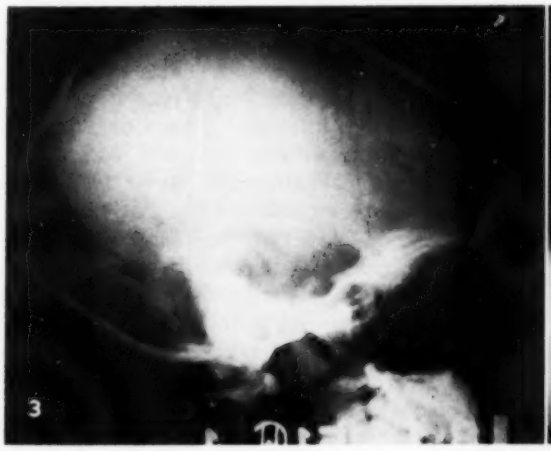


Fig. 1. Case I. Six-year-old colored girl with defect in the frontal region.
Fig. 2. Case I. Postero-anterior view of skull showing shield-shaped defect in lower frontal area with two cornua extending from superolateral margins. Metopic suture is present above and below the defect. Two large parietal foramina are seen in the uppermost portion of skull.



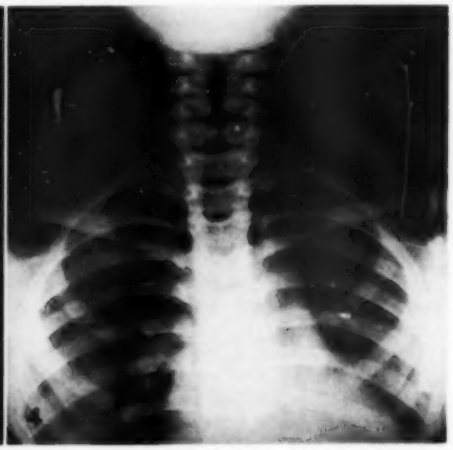


Fig. 3. Case I. Lateral view of skull.
Fig. 4. Case I. Cervical spine and clavicles. Spina bifida occulta of C-5, C-6, and C-7. Clavicles are normal in size and shape.

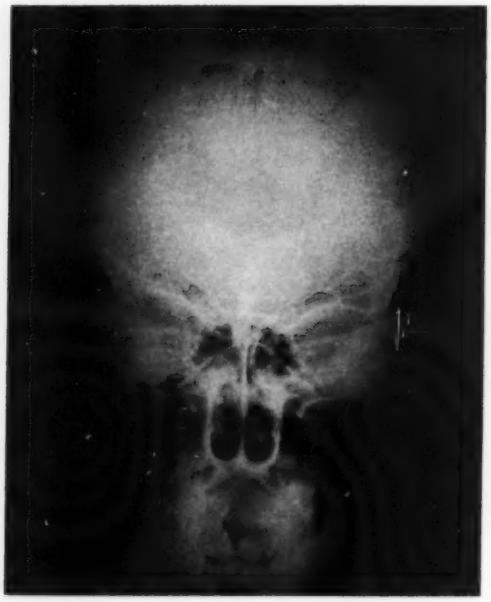


Fig. 5. Case II. Postero-anterior view of skull. The shield-shaped defect is smaller than that of Case I because of downward ossification in an attempt to obliterate the defect. There is a metopic suture above and below the defect. Tiny parietal foramina are noted in the upper portion of the skull.

of the defect were smooth and sharply delineated. Two cornua were seen to project from each superolateral margin of the gap. Short segments of the metopic suture were seen above and below the defect. There were two large parietal foramina measuring 4.0 × 2.7 cm. Spina bifida occulta was noted in C-5, C-6, and C-7. It was also present in L-5 and S-1. Roentgenograms of both shoulder girdles revealed no evidence of abnormality.

Roentgenograms (Figs. 5 and 6) of the patient's brother, 14 years of age, showed a similar but smaller shield-shaped defect 5 × 3 cm. with complete absence of bone in the midfrontal region. There was a metopic suture above and below the defect. The parietal foramina were much smaller than in the first case. Spina bifida was not present. The clavicles were normal.

The child's mother, 37 years of age, on questioning revealed that she and her mother had had "soft spots" in the forehead and on each side of the head, but as they grew older these spots had "gotten hard." The grandmother had died several years ago in Georgia and we have no history of her ever having skull films. None of the mother's siblings had any similar defects. Examination of 2 children of one of the mother's sisters showed no abnormalities of the skull.

Roentgen examination (Figs. 7 and 8), of the mother's skull showed a faint U-shaped area of decreased bone density in the midfrontal region with relative thinning of the tables of the frontal bone in that area. Small dimples were noted in the parietal bones corresponding to closed parietal foramina. There was no evidence of spina bifida. Clavicles were normal in size and shape.

Fig. 6. Case II. Lateral view of skull.

Six other children (all girls), of different ages (4, 7, 9, 10, 12, and 15 years), were examined. None of these disclosed any evidence of abnormalities of the skull, spine, or clavicles.

DISCUSSION

A review of the formation and of the presence of various anomalies of the frontal bone will throw more light on the development and final closure of the cranium bifidum frontalis found in our cases.

The development of the frontal bone as described by Inman and Saunders (8) has been fully confirmed. The frontal bone ossifies in membrane, each half from a single center appearing just above the superciliary ridge between the fortieth and fiftieth day. When the ossification appears, it spreads more rapidly in the pars frontalis than in the pars orbitalis. Heavy islands of bone are formed, extending from the ossification centers. By forces of fusion, these islands produce a series of primary radiating trabeculae, which are joined by secondary trabeculae.

Inman and Saunders further state that they were unable to find secondary centers of ossification in those regions in which they have been said to occur. In all of the 98 specimens they examined, the trabeculae were found to be continuous and unbroken.

No paired secondary centers of ossification were noted in the regions frequently reported.

The frontal bone is in two separate halves at birth and until the ninth month, when the mediofrontal suture separating these halves begins to disappear. Obliteration of the frontal sagittal suture, with the exception of its supranasal region, becomes complete at the end of the second year. The supranasal portion undergoes closure not later than the sixth year. Obliteration of the frontal sagittal suture begins at the level of the frontal tuberosities and proceeds more rapidly superiorly than inferiorly.

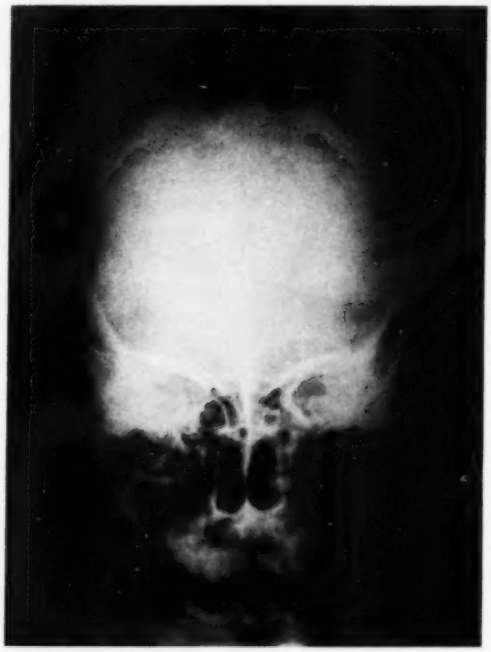


Fig. 7. Case III. Postero-anterior view of skull. U-shaped defect in lower frontal region is due to extensive downward ossification. Obliteration of the metopic suture. There are small dimples in regions of closed parietal foramina.

It has been shown by Schultz (13) that, in the early development, the frontal bones are separated by a narrow extension called the anterior long arm of the anterior (great, bregmatic) fontanelle (Fig. 9A) reaching below the frontal tuberosities. He found this condition persisting among older fetuses and newborn infants in about 15 per cent of his cases.

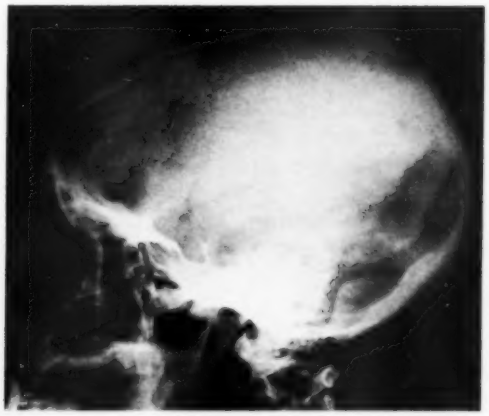


Fig. 8. Case III. Lateral view of skull.

Limson (10), in 1924, in a series of 163 skulls of fetuses and infants, found a marked variation in length of the anterior arm of the anterior fontanelle. In 25.7 per cent of his cases, the anterior arm occupied the upper quarter of the nasion—bregmatic arch. In 36.8 per cent it reached as far as the upper half of this arch, and in 14.7 per cent anywhere between the lower third and fifth or, in other words, down to and beyond the level of the frontal tuberosities.

According to Schultz, the extent to which this long arm of the anterior fontanelle becomes shortened through the advance of the developing frontal bones varies greatly. When it remains open down to and below the level of the frontal tuberosities until late in fetal life, the lowest portion of the arm is very likely to remain patent. If, however, the upper portion of the arm becomes narrower and then completely closes, the still patent lowest portion becomes a separate fontanelle known as the metopic fontanelle (Fig. 9B and C).

Metopic fontanelles vary in size, apparently depending upon the tendency to localized retardation of ossification. In some cases they persist into the postnatal period. Some of these eventually close completely. Others may close incompletely, leaving a metopic fissure.

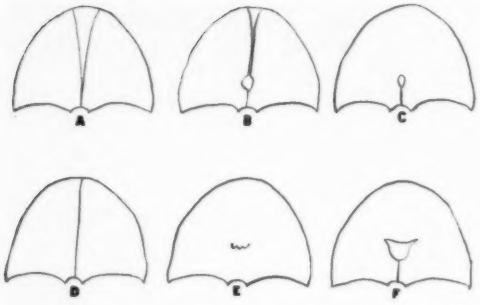


Fig. 9. A. Long arm of anterior fontanelle. B. Long arm of anterior fontanelle, metopic fontanelle, and metopic suture. C. Metopic fontanelle and metopic suture. D. Metopic suture. E. Metopic fissure. F. Cranium bifidum frontalis and metopic suture.

The metopic fissure (Fig. 9E) may be longitudinal, U-shaped, or take the form of a W. At first glance, the perpendicular fissure appears as a portion of the metopic suture, but upon closer observation the metopic fissure, unlike the metopic suture, is seen to be wide open in several places. Another point of difference is that the metopic fissure contains short and horizontal side fissures. The metopic suture is absent in two-thirds of cases with metopic fissures. Schultz has never seen the metopic suture remain patent above the metopic fissure when the suture below the fissure has been completely obliterated. It has been ascertained that the metopic fissure is more frequently encountered with a metopic suture persisting below than with one persisting throughout its entire length. The metopic fissure, unless it is unusually large, cannot be demonstrated on roentgenograms of the skull but can be seen in anatomical specimens.

Welcker (16), in 1862, disclosed that adult skulls with metopic sutures have a wide forehead and a wide interorbital region, the increase in the relative width of the latter being more striking. A similar finding has been noted in adult skulls with metopic fontanelle and metopic fissure. The cranial capacity of such skulls, however, is not increased. In fact, Fischer (5), in 1902, demonstrated a metopic fissure in a microcephalic skull.

The phenomenon of a persisting frontal suture (Fig. 9D) is known as metopism. This occurs in approximately 3 per cent of the population. Metopism may in some instances be characterized also by facial asymmetry, deviation of the nose, protrusion of the tongue and uvula, prominence of zygomatic arches and frontal eminences, and asymmetry of the ear lobes. Arachnodactylia and brachydactylia may also be present.

Fig. 10. Gradual closing, with age, of the cranium bifidum occultum frontalis. A. At 6 years (Case I). B. At 14 years (Case II). C. At 37 years (Case III).

Our cases are easily differentiated from cleidocranial dysostosis and craniofacial dysostosis. Cleidocranial dysostosis is characterized chiefly by absence of or defects in the clavicles and asymmetry of the skull and facial bones and may be associated with deformities of other portions of the skeleton. Craniofacial dysostosis presents asymmetry of the skull and facial bones which was ascribed by Crouzon to premature closure of cranial sutures. The clavicles are normal.

CONCLUSION

In view of the anatomical studies of Schultz and others, the cranium bifidum occultum frontalis in our cases can be looked upon as persistent large metopic fontanelles, and the cornua described could correspond to metopic fissures (Fig. 9F). The cranium bifidum is seen to close gradually through the years (Fig. 10A, B, and C), ossification commencing at the upper portion and proceeding downward in the defect. The downward ossification in the mother was of such extent that only a U-shaped thinning of the frontal bone was noted. We expect the girl's defect to be the same size as her brother's and mother's when she reaches their respective ages.

It is of interest to note that the cranium bifidum in our patients was associated with two other anomalies that have been shown to be hereditary as well as congential in some cases, and which also tend to close in time, *i.e.*, large parietal foramina and spina bifida occulta.

We share the opinion of Schultz and other authors that persistence of the metopic suture and formation of the metopic fontanelle and fissure represent faulty anatomical development. There is an hereditary tendency which causes retardation of the development of the lower midsagittal region of the frontal bone. The occurrence of these anatomical variations in skulls with a normal cranial capacity, and even in a microcephalic skull, and in 4 individuals in three successive generations of the same family is sufficient to exclude the theory of increased intracranial pressure as a possible cause of the defects.

SUMMARY

1. Three cases of cranium bifidum occultum frontalis have been reported in two generations of the same family. A fourth case, said to have occurred a generation earlier, has also been included. This demonstrates that the condition is hereditary as well as congenital.

2. The condition affects both males and females.

3. In the cases reported here it was transmitted only through the females.

4. Cranium bifidum occultum was associated in one case with large parietal foramina and spina bifida occulta in the cervical and lumbosacral spine. In the second case there was a smaller cranium bifidum occultum with closing parietal foramina but without spina bifida occulta. The third patient, the mother of the first two, revealed stigmata of closed cranium bifidum and closed parietal foramina.

5. No other abnormalities of the skeletal or central nervous system were associated with these defects. The patients were of normal intelligence.

6. The cranium bifidum closes by itself, as has been shown to be the case in some instances of large parietal foramina and spina bifida occulta.

7. Anatomical variations in the lower midsagittal region of the frontal bones have been discussed.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Cráneo Bífido Oculto Frontal Hereditario y Congénito con un Repaso de las Variaciones Anatómicas en la Región Mesosagital Inferior de los Huesos Frontales

Preséntanse 4 casos de cráneo bífido oculto frontal observados en tres generaciones de una familia de raza negra, lo cual demuestra que se trata de un estado hereditario a la vez que congénito.

En el más joven de los enfermos, una niña de seis años, el cráneo bífido estaba asociado con grandes agujeros parietales y espina bífida oculta en las porciones cervical y sacrolumbar del raquis. En un hermano, de catorce años, había un cráneo bífido oculto más pequeño, con agujeros parietales más pequeños y sin espina bífida. La madre de estos niños revelaba cráneo bífido cerrado y agujeros parietales cerrados. No se observó a la abuela, pero la historia era semejante a la de la madre. Estas observaciones indican que el cráneo bífido oculto se cierra gradualmente en el transcurso de los años.

Opinan los AA. que, en sus casos, cabe considerar el cráneo bífido oculto como grandes y persistentes fontanelas metópicas, y que los cuernos que se ven sobresaliendo de la brecha craneal corresponden a fisuras metópicas. Esas persistentes suturas y fisuras parecen representar vicios anatómicos del desarrollo.

Symptomatic Hepato-Diaphragmatic Interposition of Colon[1]

HARRY L. HUNTER, M.D., and ROBERT RAPP, M.D.

HEPATO-DIAPHRAGMATIC interposition is brought about by the slipping of a loop of bowel between the liver and the diaphragm. This is possible, since the major portion of the anterosuperior surface of the liver is free of ligamentous attachments. This surface of the liver, in the main, is held in contact with the diaphragm by the combined effects of the intra-abdominal and intrathoracic pressures and ligamentous support of the liver posteriorly (1).

The first description of hepato-diaphragmatic interposition has been variously attributed to Heister in 1754 (2), Béclère in 1899 (3), and Bereits in 1908 (4). Chilaiditi (5) is, however, to be credited with the first complete case report and discussion of the mechanisms involved. Information concerning incidence is sparse. Uspensky (6) found 22 cases in a review of 26,000 films taken over a period of four and one-half years.

In the earlier literature there appears to have been considerable confusion concerning the cause-and-effect relationship of colonic interposition and various accom panying abnormalities. The etiologic classification most frequently quoted is that proposed by Choussat and Choussat-Clausse (7, 8). These writers stressed as the predisposing and etiologic factors, elongation and retraction of the hepatic ligaments and reduction in the size of the liver, as well as changes of intrathoracic pressure, diaphragmatic paralysis, abnormal intestinal accumulations, and abnormal colonic mobility. One might suspect any factor which temporarily alters the balance of intrathoracic and intra-abdominal pressure (8, 9). In the past it has been stated that peptic ulcer accompanies interposition, and that the ulcer may be brought about by liver displacement and consequent interference with the blood supply and function of adjacent stomach and duodenum (10, 11). In the opinion of the authors, it is more likely that the periduodenitis, perihepatitis, and perigastritis accompanying the peptic ulcers described resulted in retraction of the liver, allowing interposition to occur. Colitis has also been mentioned as a contributing factor (10). Localized pressure atrophy of the liver resulting from long-standing or permanent interposition has been described (12). Pregnancy (13) and abdominal tumors (8) have been observed to predispose, contribute, or add to the severity of symptoms in known cases of interposition.

CASE REPORT

A 34-year-old married student presented herself at the University of Michigan Health Service at about 4:00 P.M., complaining of pain in the right upper quadrant of the abdomen. The pain had developed suddenly, shortly before noon of the same day while she was sitting quietly in a classroom, and was described as moderately severe with radiation to the region of the right scapula and right shoulder. It decreased with recumbency and quite promptly increased in severity with sitting or standing. The patient had had two full-term normal deliveries and was approximately four months pregnant at the time of observation. The rest of the medical history was not pertinent to this illness.

The patient was a well developed, normally nourished woman who was in moderate distress and slightly dyspneic when in the erect position. There was some limitation of the respiratory movements on the right, and the breath sounds on that side were slightly diminished. The right hemidiaphragmatic area of dullness was elevated posteriorly, and excursion was diminished to about 1.0 cm. Liver dullness was absent, being replaced by an area of tympany. The abdomen was soft and, except for the enlarged uterus compatible with a four months period of gestation, there were no palpable organs or masses. Slight tenderness was present in the right upper quadrant. No further pertinent physical findings were noted.

Frontal roentgenograms of the chest and abdomen disclosed the unusual appearance of the colon

[1] From the Departments of Medicine and Radiology, University of Michigan, Ann Arbor, Mich. Accepted for publication in July 1952.

interposed between the right side of the diaphragm and liver. A barium enema was given, without preparation, and filling to the hepatic flexure was accomplished without event (Fig. 1). Here it was immediately noticed that the proximal limb of the hepatic flexure was twisted to occupy a position just posterior to the transverse colon, bringing about

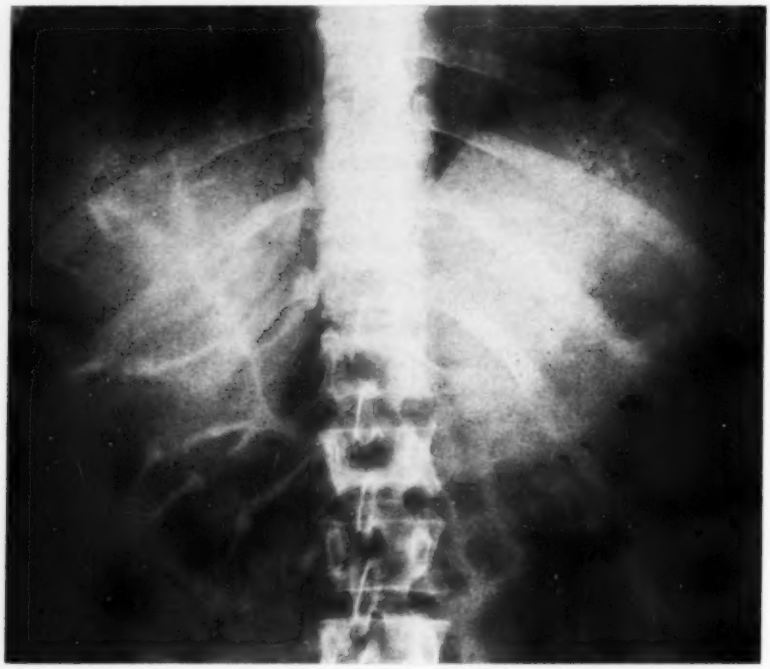

Fig. 1. Scout film of the abdomen. Note the high position of the hepatic flexure as outlined by colonic gas.

torsion of the colonic wall at that point. The lumen here was only slightly reduced. In order to visualize this area to better advantage, the patient was rotated from the supine to an almost prone position with the right side down. During this maneuver a sudden descent of the hepatic flexure occurred, and interposition of the colon disappeared. The colon then occupied a normal position throughout its length, and the patient experienced complete relief of her symptoms upon assuming the erect position. Figure 2 is a single spot film made at the fluoroscopic screen, demonstrating the torsion of the colonic wall. Figure 3 shows a normal colon, as it appeared on films made at the conclusion of the examination.

The patient gave birth to a normal infant about five months after the episode described, and the colon was normal in configuration and position about six months following the interposition.

DISCUSSION

Most authors state that the diagnosis of hepato-diaphragmatic interposition is made by roentgenologic examination. While this may be true, physical examination alone may raise a strong suspicion of the presence of this condition, the cardinal point being replacement of the usual area of liver dullness by an area of tympany in the presence of a non-rigid abdomen. This finding is also present in pneumoperitoneum, which may be induced as a diagnostic or therapeutic measure, or may be subsequent to recent operation or any diagnostic test which uses gas to determine tubal patency. Pneumoperitoneum, however, can ordinarily be excluded by the clinical history.

Additional support to the presumptive diagnosis is furnished by evidence of diaphragmatic irritation, with a history or findings suggesting any of the predisposing conditions for interposition of the colon. The type of pain and other symptoms associated with interposition of the colon can be quite variable and non-specific (11, 14, 15, 16).

X-ray diagnosis is based on a gas-filled

loop of intestine interposed between diaphragm and liver in frontal films of the chest and/or abdomen (17). Differentiation must be made from free or encapsulated gas in this area, including such conditions as pneumoperitoneum, air cysts,

Fig. 2. Spot film of the hepatic flexure made at the fluoroscope. Note the course of the colon and its twisted appearance at point where it is projected over the spine. Defects within the barium column are produced by fecal material. There is no closed loop obstruction typical of complete volvulus.

and subphrenic abscesses (2). The presence of haustral marking or valvulae conniventes usually establishes the fact that the gas is present within the interposed intestine. Barium enema or barium meal will aid in determination of the type of intestine involved. The former may disclose additional abnormality or aid in reduction of colonic interposition. The latter may disclose enteric (small intestinal) interposition and duodenal displacement or compression, if present.

Treatment, if necessary, according to most authors, is either symptomatic in nature or is aimed at one or more of the accompanying pathologic conditions (6, 10, 11). Diet, positional exercises, and drugs altering intestinal tonus have also been proposed. The interposed bowel may become fixed in position by virtue of in-

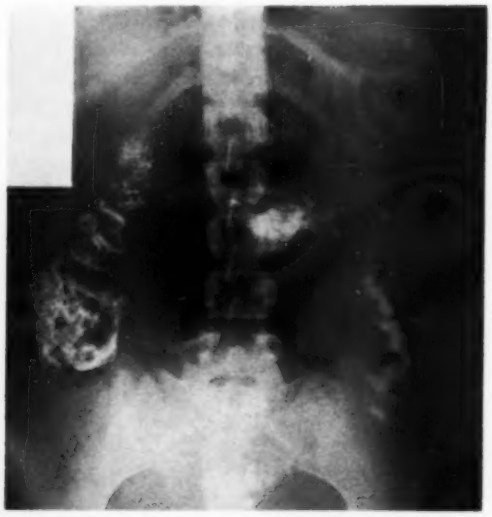

Fig. 3. Post-evacuation film of the abdomen after barium enema. Note the position of the hepatic flexure in relation to the diaphragm, which is just above the upper margin of the film.

flammatory and adhesive processes (4), requiring operative reduction.

Temporary interposition of the colon may be reduced by barium enema. It is important, therefore, to know whether the interposition is colonic or enteric, temporary or permanent. If reduction is to be done in this manner, the condition of the colonic segment involved must be taken into account, because of the potential danger of reducing an avascular segment. In the case described, this consideration was of little concern, as compression and torsion were minimal and of short duration.

Interposition is generally accepted as an incidental roentgenologic finding, but should not always be so regarded. Reports are accumulating in which recognition and treatment of this condition have become important to the well-being of the patient. Misinterpretation of roentgenologic evidence has occasionally led to an incorrect diagnosis of perforated viscus and operation (2). In several cases, volvulus has been interposed between the right side of the liver and the diaphragm (18, 19). In the case presented, simple reduction was accomplished and relief of distress has persisted to date.

Interposition may involve any portion of the intestine supported by a free mesentery, although colonic interposition is more frequent than the enteric type (20). It may occur in any age group and may be symptomatic or asymptomatic, reducible or permanently fixed (6), congenital or acquired (12), spontaneous or incident to a number of factors already described. It must be differentiated from conditions leading to the roentgen appearance of gas between diaphragm and liver and may be coexistent with acute abdominal conditions (20). In the presence of signs and symptoms, diagnosis can be suspected prior to x-ray examination. Barium enema is recommended, especially in symptomatic cases, for its diagnostic and therapeutic values.

CONCLUSIONS

1. Occasionally interposition of the colon between the liver and diaphragm can be tentatively diagnosed by history and physical examination.

2. Non-fixed colonic interposition is occasionally reducible by barium enema, as demonstrated in the case presented and at least one other case in the literature (8).

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SUMARIO

Interposición Hepato-Diafragmática Sintomática del Colon

En el caso descrito, los síntomas y signos físicos sugerían migración de una parte del colon derecho al espacio potencial que queda entre el diafragma y el lóbulo mayor del hígado. La interposición del colon entre el hígado y el diafragma fué revelada por una radiografía exploradora del abdomen. Durante un estudio con enema de bario, el colon volvió a su posición normal y se aliviaron los sintomas.

Es muy indicativo de interposición hepato-diafragmática el reemplazo de la habitual zona de matidez hepática por una zona de timpanismo sin rigidez del abdomen. El diagnóstico roentgenológico se basa en el descubrimiento del asa intestinal llena de gas y desplazada. Si el colon interpuesto no está todavía fijado, puede a veces reducirse con un enema de bario.

A Simple Device for Saving Films in Radiography of the Intestine[1]

SOL FINEMAN, M.D.

IN EXAMINING the intestine of stocky or obese individuals, it is often impossible to depict the entire small and/or large intestine on a single 14 × 17-inch film, placed lengthwise under the patient. Segments of the intestine situated in the flanks may be projected beyond the film limits and, therefore, may not be visualized on the roentgenograms. A single 14 × 17-inch film placed crosswise, while offering a sufficiently large film surface for the intestinal loops located in the flanks, may not be long enough in the cephalocaudal direction for visualization of the entire intestine. In such cases, therefore, one has to use two films, placed crosswise, to show roentgenographically the entire small and/or large intestine, either after the barium meal or barium enema or after both procedures. This obviously doubles the cost of films, as well as the wear and tear on the x-ray tubes and other equipment, resulting in an economic factor of considerable importance in the performance of detailed serial or multiple x-ray examinations of the intestinal tract.

The writer has designed a simple adjustable abdominal cloth binder, with pockets in the flanks for the standard 10 × 13-inch rubber rectangular compression bladders, which is laced loosely over the patient's abdomen, with the compression bladders resting against the flanks. In most instances, when the patient's flanks are moderately compressed by inflation of the bladders, this permits radiography of all of the barium-filled loops of the intestine on a single 14 × 17-inch film, placed in the usual lengthwise position. The bladders are inflated by connecting them to a source of compressed carbon dioxide, *e.g.*, a small fire extinguisher or tire inflator (Fig. 1).

Fig. 1. Photograph showing compression of patient's flanks by inflation of the bladders of the abdominal binder.

The binder is made of lightweight canvas, the eyelets are reinforced by buttonhole stitching, and the laces are of cotton laced loosely in position with the rubber compression bladders at the flanks of the braid, none of which cast any shadow on the roentgenogram. The inflated rubber compression bags at the flanks are entirely, or almost entirely, off the limits of the film; when partly demonstrable, they present faint shadows, peripheral to the intestine, which do not in any way interfere with visualization of the latter.

The cloth panels are constructed with two or three rows of eyelets spaced about 1 1/2 inches apart, to allow snug lacing of the panels on patients of varying girth.

[1] Presented at the Eastern Conference of Radiologists, New York, N. Y., March 28, 1952. Accepted for publication in June 1952.

The abdominal binder is applied and laced loosely in position with the rubber compression bladders at the flanks of the patient. The rubber hose terminals of the bladders are connected through intermediary straight, short, glass connecting tubes and a glass Y tube to the long hose connections of a cylinder of compressed carbon dioxide (Fig. 2). The application and lacing of the binder require only a few moments.

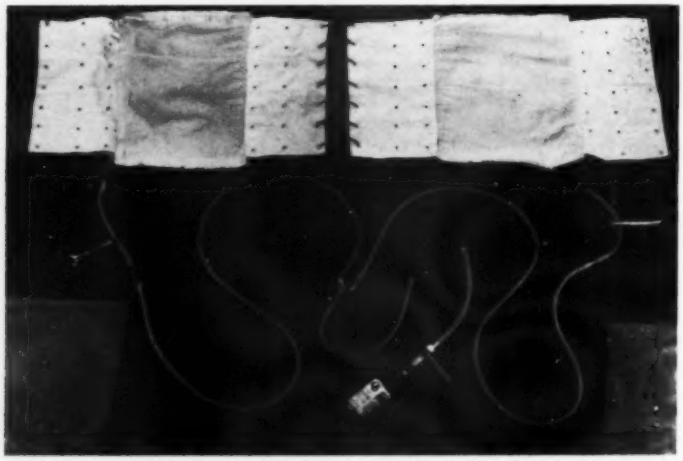

Fig. 2. Abdominal cloth binder with side pockets for the standard 10 × 13-inch rubber rectangular compression bladders. The rows of eyelets in the cloth panels are for adjustment of the binder circumference to the girth of the patient. The short rubber hose terminals of the compression bladders may be clamped by artery forceps and disconnected from the carbon dioxide cylinder with its long hose connections, to permit the patient freedom of movement.

Fluoroscopic study of the intestine is carried out before the compression bladders are inflated. This examination is in no way hindered by the presence of the binder with its deflated bladders. After completion of fluoroscopy the compression bladders are inflated under fluoroscopic control by opening slightly the valve of the small carbon dioxide cylinder.[2]

Slight compression of the flanks is all that is usually necessary to shift medially the ascending and descending segments of the colon so that the shadows of these structures will fall within the confines of the 14-inch width of the film (Figs. 3 to 9).

[2] For more economical use of the carbon dioxide in the cylinder, the manufacturers recommend opening the valve with the cylinder held in the upright position.

The inflation of the compression bladders is a simple procedure which requires but a few seconds. The degree of flank compression necessary is generally slight and in the experience of the writer has not caused the patients any discomfort, nor has it created difficulties in obtaining films in barium enema studies prior to evacuation of the enema. It must be remembered, however, that some patients can not retain a barium enema under any circumstances, even when administered in the routine manner and without compression.

As soon as the compression bladders are inflated, artery forceps are clamped on the short rubber hose terminals to prevent escape of the gas, and the terminals are disconnected from the long rubber hose connections of the carbon dioxide cylinder. This permits unhampered rotation of the patient for radiography in the oblique and postero-anterior postions and also permits the ambulatory patient to get off the x-ray table for evacuation of the barium enema, with the inflated abdominal binder *in situ*. The inflated compression bladders do not interfere with evacuation. In some instances, partial deflation of the bladders, may make the patient more comfortable.

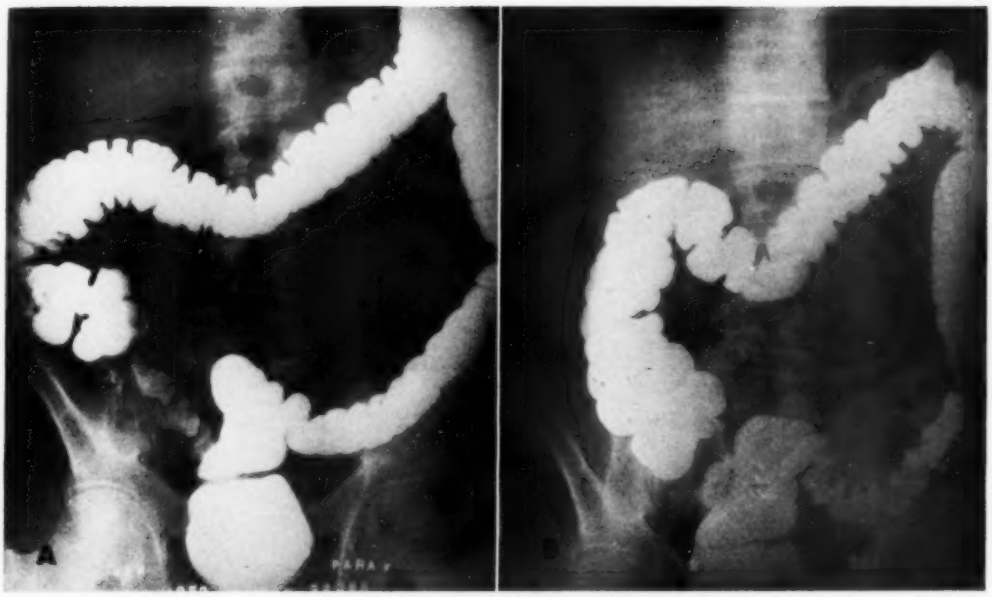

Fig. 3A and B. Case 1. Roentgenograms of the colon (barium enema study) to show non-visualization of a segment of the descending colon without flank compression and visualization of the missing bowel segment after flank compression.

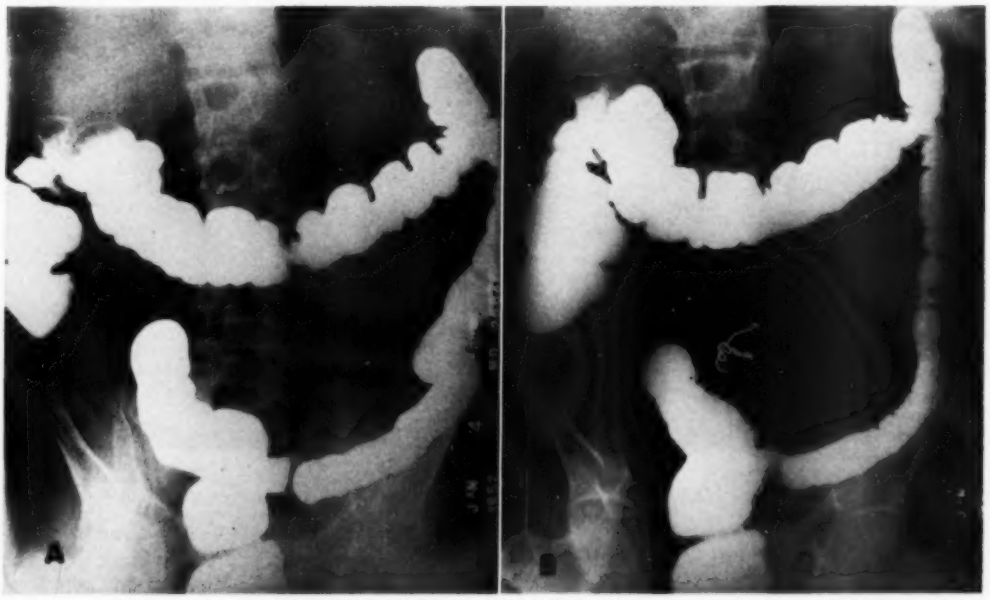

Fig. 4A and B. Case 2. Roentgenograms of the colon (barium enema study) to show non-visualization of segments of the ceco-ascending and descending colon without flank compression and visualization of both missing colon segments after flank compression.

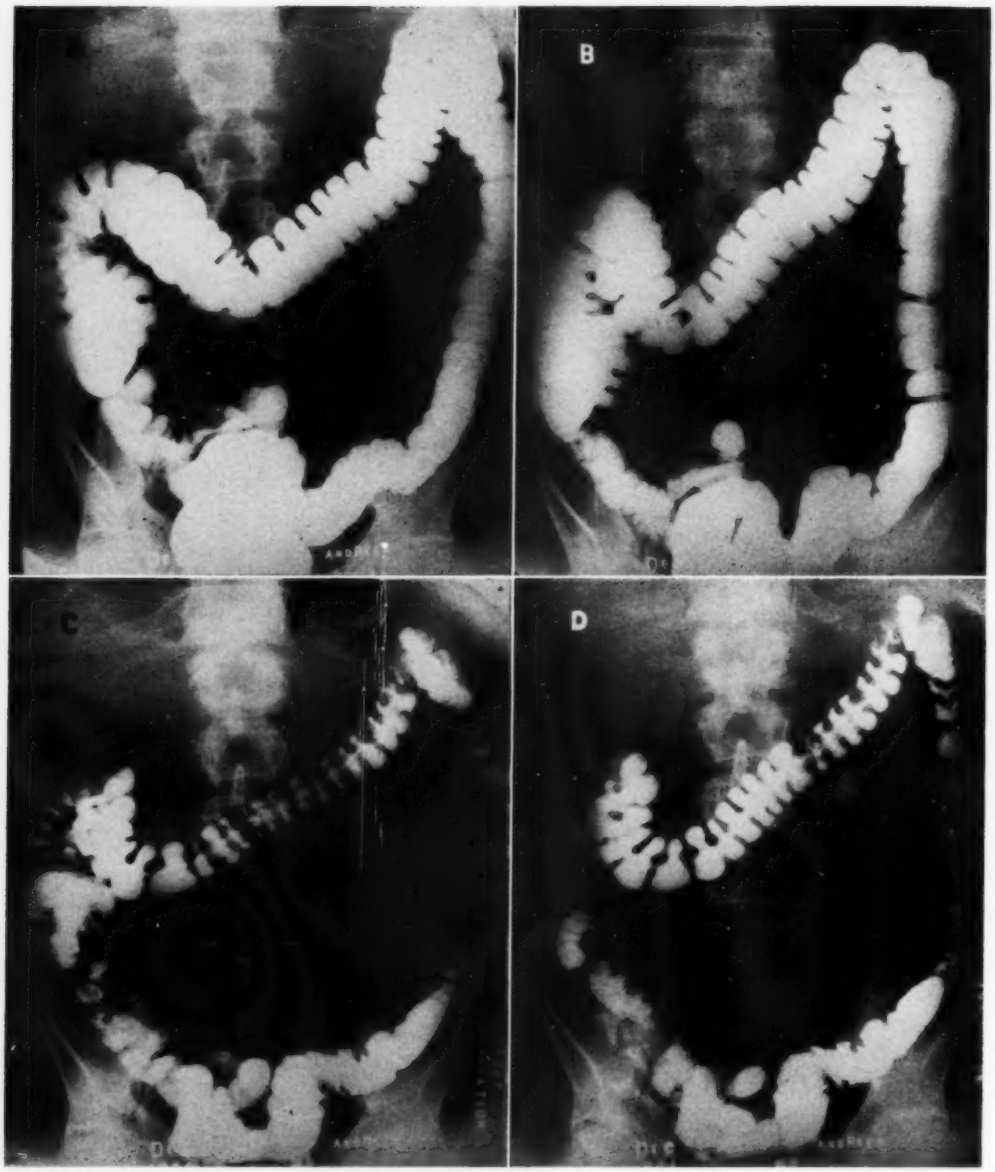

Fig. 5A, B, C and D. Case 3. Fig. 5A and B are roentgenograms of the colon after a barium enema study to show non-visualization of the outer portion of the descending colon without flank compression and visualization of the missing part of the colon after flank compression. Fig. 5C and D are roentgenograms of the same case after evacuation of the barium enema. Even after evacuation, it was not possible to depict the entire colon on the one 14 × 17-inch film without flank compression. Fig. 5D shows visualization of the entire colon after flank compression.

Reinflation may not be necessary in these cases due to the postevacuation contraction of the colon and the shift medially of the ascending and descending loops. If fluoroscopy shows these loops to be still beyond the lateral limits of the film, reinflation of the compression bags is easily done, requiring but a few moments.

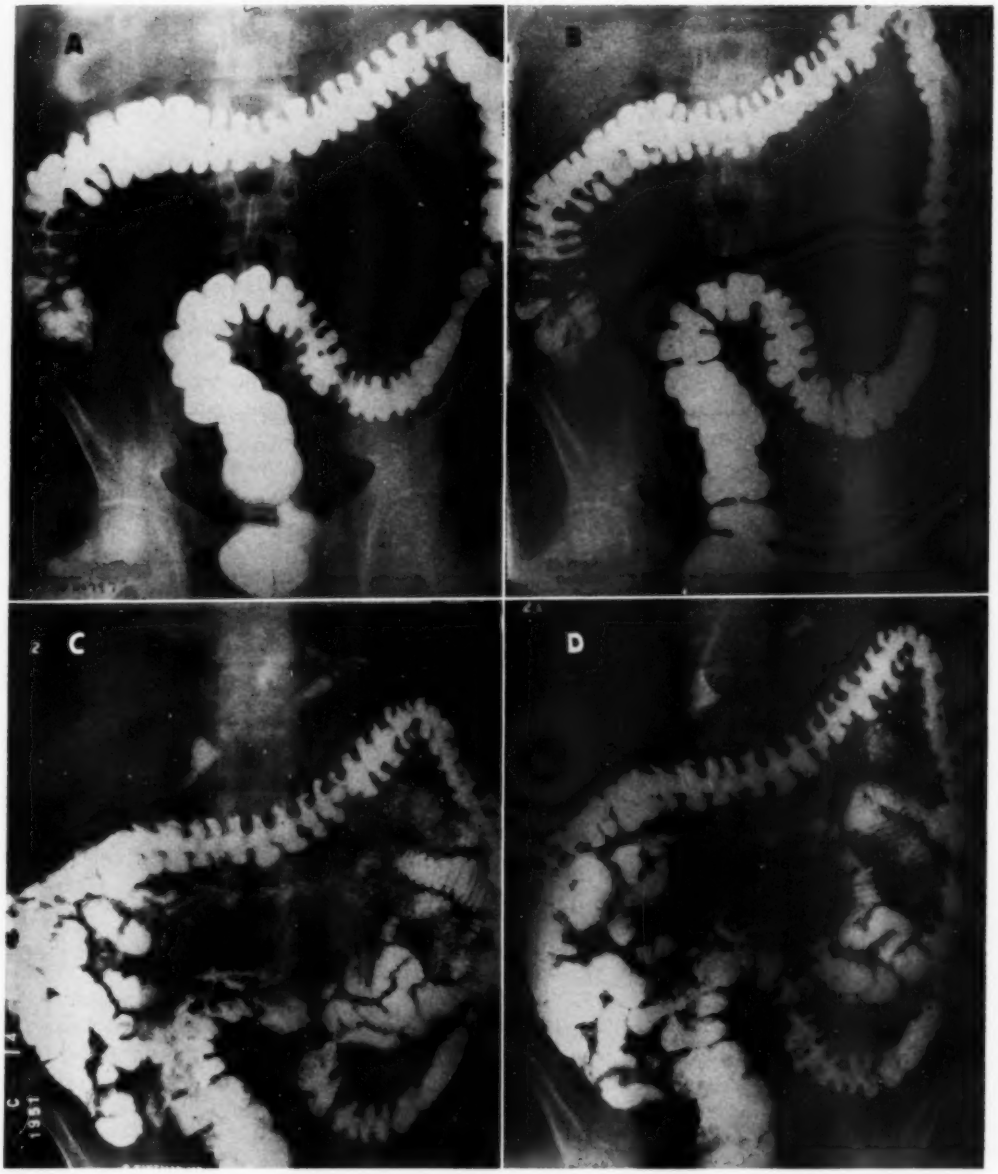

Fig. 6A, B, C and D. Case 4. Fig. 6A and B are roentgenograms of the colon after a barium enema study to show non-visualization of the outer portion of the descending colon without flank compression and visualization of the missing part of the colon after flank compression. Fig. 6C and D are roentgenograms of the small and large intestine after a barium meal, illustrating the difficulty of visualizing the segments of the bowel in the flanks without flank compression and satisfactory visualization of the intestine after flank compression.

With the exception of those cases in which the intestine is of the elongated type and extends beyond the limits of the 14 × 17-inch film in the cephalocaudal direction, the method has been found applicable in most cases and valuable because of the factors of film saving, lessened wear of the x-ray tubes and processing materials, re-

duced work for the technician, and diminished exposure of the patient to the roentgen rays. An additional advantage is the achievement of continuity of all visualized portions of the bowel on one film, avoiding the necessity of viewing the intestine in sections on separate films.

ACKNOWLEDGMENT: The author wishes to express his thanks to Beacon Devices, Inc., of North Tonawanda, N. Y., for generously supplying the small cylinders of compressed carbon dioxide used in this work.

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SUMARIO

Sencillo Aparato para Economizar Películas en la Radiografía del Intestino

El aparatito descrito evita la necesidad de usar dos radiografías para la observación del tubo intestinal en los enfermos rechonchos u obesos. Consta de una faja graduable de lona, que se ata flojamente sobre el abdomen, y lleva a los lados bolsillos que acomodan las vejigas corrientes de caucho de 25 x 32.5 cm. para compresión. En la mayor parte de los casos, la compresión moderada de los costados del enfermo por la inflación de las vejigas permite descubrir todas las asas intestinales llenas de bario en una sola película de 35 x 42.5 cm., colocada en la habitual posición longitudinal. Las vejigas se hinchan conectándolas con un depósito de bióxido de carbono comprimido, como los de matafuegos o inflaneumáticos. Los estudios roentgenoscópicos se ejecutan antes de hinchar las vejigas de compresión.

A Rapid Film-Changing Device for General Radiography

Preliminary Report[1]

LEO G. RIGLER, M.D., and JOHN C. WATSON, R.T.

MANY AND VARIED instruments have been devised to permit the rapid changing of films or cassettes for special procedures in roentgen diagnosis, particularly in the field of angiography. One of the most commonly used types of apparatus for this purpose embodies a magazine loaded with a roll of film; the latter is moved rapidly between intensifying screens. The device will permit two exposures per second. Each year has brought forth several such pieces of apparatus, attesting to the fact that none available on the market are entirely satisfactory. Since such devices are expensive and as presently constructed are very limited in their utility, they are not commonly found outside of large institutions.

The use of roll film for conventional x-ray examinations has had very little experimentation. At one time x-ray paper of 14 × 17-inch size was prepared on a roll for the rapid radiography of the chest, as a survey procedure, but this has largely been superseded by photofluorography. In the latter, roll film has been utilized. The economy of time in the radiography of large numbers of individuals, which is attained by the use of a continuous strip of film, is one of the major benefits accomplished by photofluorography.

A rapid film-changing unit, utilizing a continuous roll of film, which would permit as many as five exposures per second, when necessary, and yet would be useful for general conventional radiography would seem to be a highly desirable development. The equipment available at present is not suitable for several reasons. First, it is made only in one size; secondly, and more important, it is extremely difficult and cumbersome to interrupt the procedure before the entire roll is exposed.

For the past year or more Robert Sardeson and Karl Kallenberg of the Pako Corporation, of Minneapolis, at the suggestion of and with the co-operation of the Department of Radiology of the University of Minnesota, have been working to devise a unit which will overcome many of the difficulties now affecting rapid film-changing mechanisms, in order to permit their use in general routine radiography. Such a unit should supplant the cumbersome, expensive, time-consuming procedure of making each x-ray exposure on a separate cassette—in fact, it should supplant the cassette entirely wherever there is a reasonably substantial volume of radiographic work.

The unit utilizes roll film which is advanced through a pair of intensifying screens at a maximum speed of five films per second. As each succeeding film is advanced into the exposure area, the previously exposed film is cut off by a motor-driven knife, so timed that its action will occur as the screens come into contact for the following exposure. The cut film is then transported to a receiving magazine as the next frame is being brought into the exposure area. An ingeniously designed clutch and braking arrangement permits all of these actions to complement one another so that at the exact time of exposure there is no motion whatever. The receiving magazine has a maximum capacity of 30 cut films. It can be removed and transported to the processing room at any time, whether it contains one or more exposed films. A second receiver can be installed without movement of the machine as a whole. Likewise, a new roll of unexposed film may be installed without disconnecting the unit or taking it to the dark room.

The unit is constructed to fit the con-

[1] From the Department of Radiology, University of Minnesota Medical School, Minneapolis, Minn. Accepted for publication in January 1953.

ventional radiographic table or stereoscopic cassette changer. In a table, the unit substitutes for the Bucky diaphragm tray, permitting the use of the conventional diaphragm or any variation of it. The depth of the unit including the receiver is less than 11 inches, so that almost all tables have sufficient space for its installation. Likewise, it may be used upright, as in the conventional cassette holder used for chest radiography. The mechanical action of the unit is controlled and "led" by the control unit of the x-ray machine. It is therefore possible to make more than one exposure on a given film area by properly protecting it, just as is presently done with cassettes. The present plan is to make the unit available with 12 × 12-inch apertures when used in conjunction with a radiographic table and 14 × 17-inch apertures when used in conjunction with an upright cassette changer. But the unit may well be constructed with smaller sized openings also.

Anyone with experience in routine radiography on a large scale, as in large clinics and hospitals, will appreciate at once the enormous advantages such a unit should have in comparison with present-day methods of radiography. The unit should accomplish the following:

1. Eliminate the cost and upkeep of numerous cassettes and intensifying screens.
2. Eliminate screen artefacts, as the screens are sealed within the unit and have no contact with chemicals, are not touched by hands, are completely dust-free.
3. Lower the film cost, as the use of roll film will eliminate many costly packing and cutting operations in film manufacture.
4. Eliminate the time-consuming placement of cassettes, carrying them into the dark room, loading and unloading individually. In almost any department, the labor per case would be greatly reduced.
5. Where photographic identifiers are used, reduce errors in identification, since all the films on one examination should come into the dark room in one envelope together.
6. Make the location of the processing room in a large department much less important than it is presently, as the transportation of the film to the radiographic room and back to the processing room would be accomplished far more easily than is now the case with the use of heavy cassettes.
7. Decrease very appreciably the storage area now needed in the processing room.
8. Embody all the advantages of roll-film procedures, including the possibility of rapid exposures up to five per second, and still permit the radiographic procedure to be stopped with only one film exposed so that one may be developed immediately.

Obviously, such a device is most useful in a department where various types of examination are concentrated in different rooms. Only one size of film could be used at one time in any table, but the wastage of film thus resulting would be much more than compensated by the economy of time. It seems readily conceivable that in radiography of the chest, the rapidity which can be achieved by the roll-film method, combined with the real advantages of the life-sized film, might diminish the need for photofluorography, except where it was being done as a purely survey procedure.

The unit also has many advantages in the field of vascular radiology, namely:

1. It will permit five films to be exposed per second, utilizing a reciprocating Bucky diaphragm.
2. It can be made a part of a conventional table, thus facilitating positioning and increasing its utility.
3. Because the x-ray control unit leads the exposure, intermittent rapid film work is possible.
4. It eliminates the problems posed in the processing of large film on a roll.
5. It will permit a trial of exposure factors, positioning, etc., before injection of contrast medium, since the first

trial films may be developed without moving the unit or the patient.

At the time of this preliminary report, the engineering model of this apparatus has been completed and has been tested experimentally. It performs the functions described above satisfactorily. We are now setting up actual tests under standard operating conditions in the Department of Radiology of the University of Minnesota Hospitals to run the gamut of radiographic procedures in order to determine its practical usefulness for conventional radiography. At the present time no model other than that being used in this department is available. Although the first unit embodies all the features described above, no doubt further improvements may be achieved when sufficient experience in the practical use of the device has been obtained.

SUMMARY

A rapid film-changing unit, utilizing roll film, which may be useful for general radiography, as well as for angiography, is described.

Its design is such as to permit its substitution for conventional cassettes and intensifying screens in many types of radiography, thus conserving time and labor.

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SUMARIO

Rápido Cambiapelículas para la Radiografía General: Informe Preliminar

Descríbese un cambiaplacas rápido que utiliza rollos de películas y puede utilizarse para la radiografía general e igualmente para la angiografía. Está diseñado de modo que puede emplearse en vez de los chasis corrientes y pantallas intensificadoras en muchas clases de exámenes, ahorrando así tiempo y trabajo.

La película camina a través de un par de pantallas intensificadoras a razón de cinco radiografías por segundo. A medida que cada radiografía sucesiva pasa a la zona de exposición, corta la película expuesta antes una cuchilla impulsada por electromotor, graduada de modo que entre en juego cuando las pantallas se ponen en contacto para la exposición siguiente. La película cortada va luego a una cámara receptora cuando el chasis siguiente avanza a la zona de exposición. La cámara receptora posee una capacidad máxima de 30 películas cortadas, pudiendo ser retirada y llevada cuando se desee al cuarto de preparación, ya contenga una o más películas expuestas.

La acción mecánica del dispositivo se gobierna e "inicia" por el dispositivo regulador del aparato de rayos X, por lo cual es posible verificar más de una exposición en una zona dada de película, resguardándola debidamente, lo mismo que se hace ahora con los chasis.

A Device to Support Patients During Upright Fluoroscopic Examinations[1]

HOWARD L. STEINBACH, M.D., and LEE B. LUSTED, M.D.

RADIOLOGISTS frequently are called upon to perform fluoroscopic examinations on patients who are feeble, confused, unsteady in the dark, or unable to stand. Many are apprehensive upon being ushered into a dark room and may have transient episodes of vertigo and fainting, probably due to vasodepressor syncope. Some have fallen to the floor while undergoing fluoroscopic examinations. It is desirable, nevertheless, to do fluoroscopic examinations with the patient erect.

A simple device was constructed for supporting patients in an erect position on the fluoroscope. This support has proved to be practical in examining children in the upright position when they have been immobilized on the "Brattbored" devised by Miller. For adults the device is not so much for support as for prevention of falling if loss of consciousness occurs.

This device consists of a 2-inch steel hook, a 70-inch leather belt 1 1/4 inches wide with a metal buckle at one end, a steel ring 3 inches in diameter, and cotton webbing 2 inches wide and 40 inches long, with a dog snap on each end. For short patients the leather strap length permits the steel ring to be placed 51 inches from the foot support. A hole must be drilled into the head end of the table into which the steel hook can be inserted.

The suspending device is easily applied and removed. For adults the hook is inserted into the hole in the table. The

Fig. 1. The suspensory device, consisting of a steel hook, a 70-inch leather belt with a metal buckle at one end, a steel ring 3 inches in diameter, cotton webbing 2 inches wide and 40 inches long, and two dog snaps.

Fig. 2. The suspensory device in position. The metal hook is inserted into a hole at the head end of the table.

[1] From the Department of Radiology, University of California School of Medicine, San Francisco, Calif. Accepted for publication in July 1952.

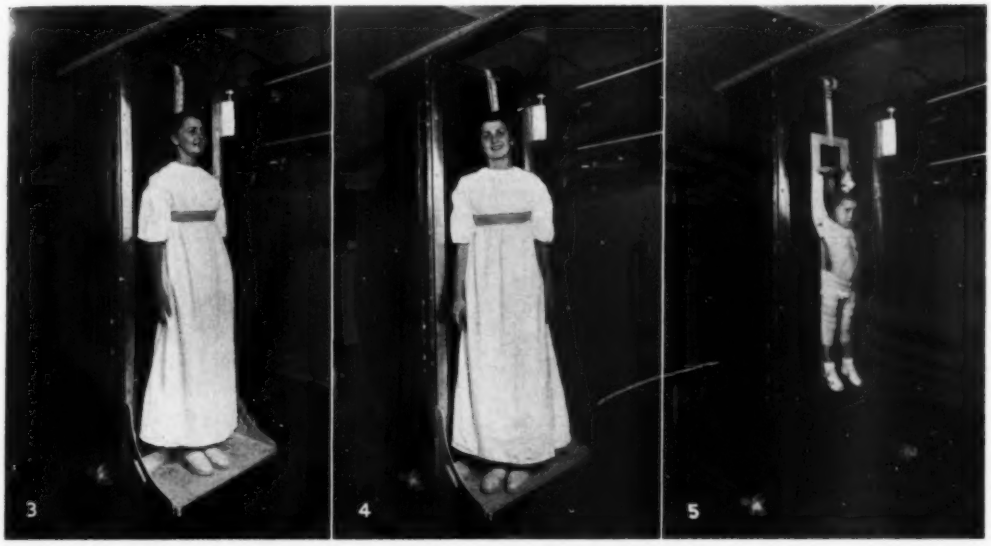

Fig. 3. A patient being supported by the device. The leather strap has been adjusted to the proper height and the dog snaps are attached to the metal ring. Towels may be placed under the axillae for greater comfort.
Fig. 4. The patient may be rotated freely during the examination.
Fig. 5 Children may be examined in the upright position by immobilizing them on a "Brattbored" and suspending the board with the leather belt. The height can be adjusted and the children are easily rotated.

cotton webbing is then passed across the front of the chest and under the axillae, and attached to the metal ring with the dog snaps (Fig. 3 and 4). The leather strap is then adjusted to the proper height. Towels may be placed in the axillae to make the patient more comfortable. For children, only the leather belt is used. The child is immobilized on a "Brattbored" and then the leather belt is passed about the plywood bar at the top of the board and adjusted to the proper height (Fig. 5).

The suspending device does not interfere with the fluoroscopic examination. The cotton webbing does not produce a visible shadow, and the patient can be rotated easily in either direction. Patients feel quite comfortable and much more secure knowing they cannot fall.

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SUMARIO

Aparato para Sostener en la Posición Erecta a los Enfermos Durante el Examen Roentgenoscópico

El sencillo aparato aquí descrito permite sostener a los enfermos en la posición erecta durante la roentgenoscopia. Consta de un gancho de acero, un cinturón de cuero de unos 2.15 m. de largo con su hebilla, una anilla de acero de 7.5 cm. de diámetro, una cincha de algodón de 5 cm. de ancho y 1 m. de largo y 2 corchetes de los que se usan en las traíllas de los perros.

El gancho se introduce en un agujero en el extremo de la cabeza de la mesa; la cincha se pasa alrededor del pecho del enfermo y se asegura con los corchetes a la anilla de metal. Luego se ajusta el cinturón a la altura correspondiente.

Para los niños se usa el aparato con el accesorio descrito por Miller (Radiology 58: 421, 1952.)

Observations of the Scattered Radiation Inside and Outside a 1,000-Curie Cobalt^{60} Teletherapy Room[1]

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IN THE PAST, protection against large radioactive sources has been determined by use of available attenuation data. This necessitates a certain amount of approximation and may in some instances result in over or inadequate protection. With increasing energy and intensity of gamma-ray sources, economy in protection becomes more and more important. To insure as great economy as possible, knowledge of all factors entering into the calculation of protection is required. This factor is understandably more important in altering rooms to provide adequate protection rather than in new construction.

The problem of protection against large cobalt teletherapy units has been discussed by Mayneord (1950) and Dixon *et al.* (1952). Additional information is given here to indicate where economies in installation may be realized. Measurements of the amount of scattered radiation around such a large source under actual treatment conditions have been taken. These measurements indicate how applicable are the available attenuation data to the many problems of protection.

In view of the possibility of the machine being operated for a period requiring the shutter to be open eight hours a day, the protection was calculated for this period of operation. This means that leakage must be limited to a rate of not more than 6.25 milliroentgens (mr) per hour if we accept the tolerance dose as being 50 mr per day.

TREATMENT ROOM

The Eldorado Cobalt^{60} Teletherapy Unit, described elsewhere by Green (1952), is installed in a temporary treatment room in the basement of the hospital. The walls were so constructed that they could be removed with a minimum of difficulty. From a protection standpoint, the location is ideal, as no added protection was required in the floor and it was possible to direct the beam at an outside wall. The inside dimensions of the room (Fig. 1) are 13 × 17 feet; the maze measures 9.5 × 6 feet. All walls are constructed of solid concrete blocks, 4 inches thick, with solid mortar seams. The walls, 8.5 inches in thickness, are constructed of two layers of blocks with their joints staggered. The density of concrete block is 142 lb./cu. ft. Protection in the ceiling consists of 4 inches of concrete plus 1/4 inch of lead. Protection in the direct beam is supplied by sandbags built up to a height of 9 feet above floor level and extending 6 feet beyond the outside wall. The observation window consists of a lead glass brick 4 × 8 inches in area and equivalent in thickness to 2 inches of lead. The glass provides ideal protection and has not deteriorated in any way after six months use. The size of the window is minimum and does not allow a very large field of vision.

SCATTERED RADIATION OUTSIDE OF TREATMENT ROOM

Measurements of the amount of radiation outside the room were undertaken with a Tracerlab "cutie pie" and a Lauritsen electroscope. These instruments were calibrated against known radium and x-ray sources.

The amount of radiation penetrating to the outer extremity of the sandbags with the beam horizontal and passing through a water phantom is 2 mr/hour. Results of measurements of the stray radiation outside the room are listed in Table I. Meas-

[1] From the Ontario Cancer Foundation Clinic, Victoria Hospital, London, Ontario, Canada. Accepted for publication in July 1952.

urements were taken with a large water phantom in a radiation field 20 × 20 cm. at a F.S.D. of 100 cm. These values indicate that all walls would be underprotected if space immediately outside was permanently occupied and the machine was used continuously under the most hazardous operating conditions. The amount of radiation passing through the ceiling could not be detected with the instruments used except when a beam of large cross section was directed horizontally into a phantom. In this latter position, it is possible to measure scattered radiation over an area 3 × 6 feet directly above the path of the beam at a distance of 8 feet. Over this area the maximum reading was

TABLE I: SCATTERED RADIATION OUTSIDE COBALT TELETHERAPY ROOM

(Field 20 × 20 cm. F.S.D. 100 cm. Dose rate 20 r/min. All values in mr/hour)

Position Indicated in Fig. 1	Beam Horizontal		Beam Vertical	
	Floor Level	5 feet (above floor)	Floor Level	5 feet (above floor)
A	14.0	16.5	1.5	1.5
B	4.5	4.5	16.0	8.0
C	0.5	0.5	5.0	2.0
D	0.5	0.5	6.5	3.0
E	0.5	0.5	3.5	1.5
F	0.5	0.5	6.5	3.0
G	0.5	0.5	2.5	1.0
H	0.5	0.5	4.5	2.0
J	1.0	1.0	6.0	3.0
K	0.5	0.5		
L	0.5	0.5		
M	3.5	3.5		
N	2.0	(9 feet)		
P	135.0	(7 feet)		

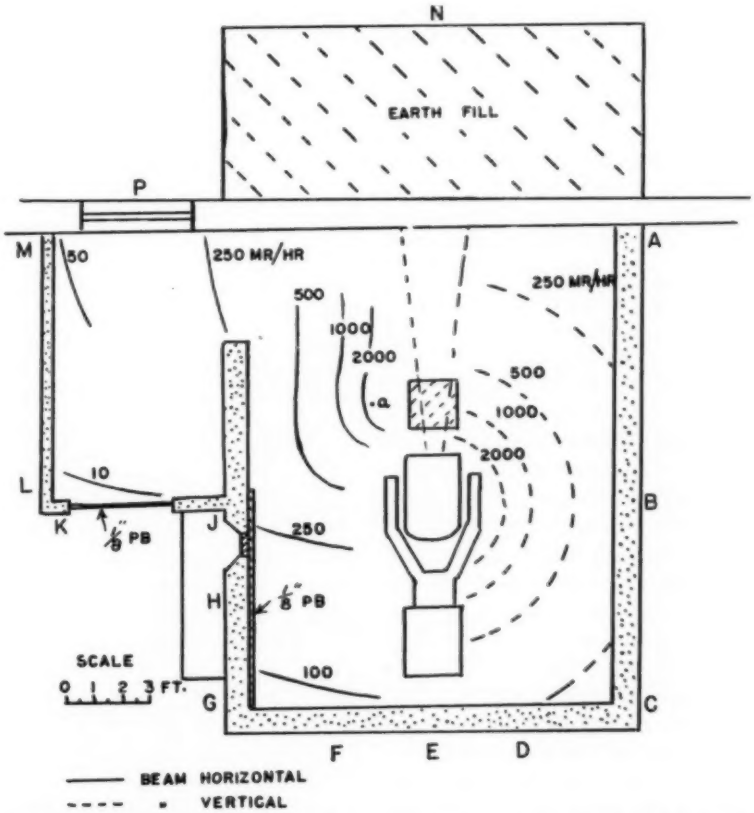

Fig. 1. Cobalt^{60} teletherapy room, showing the amount of scattered radiation inside room. Field: 20 × 20 cm. F.S.D.: 100 cm. Phantom: 50 × 50 × 25 cm.

TABLE II: SCATTERED RADIATION INSIDE COBALT TELETHERAPY ROOM

(Field 20 × 20 cm. F.S.D. 100 cm. Phantom 50 × 50 × 25 cm. Dose rate 20 r/min. All values in mr/hour)

Position Indicated in Fig. 1	Beam Horizontal (3 feet above floor)	Beam Vertical (3 feet above floor)
A	350	100
B	250	350
C	100	200
D	100	300
E	75	200
F	100	300
G	100	200
H	150	275
J	250	350
K	10	
L	10	
M	50	

6.0 mr/hour. Beyond this area, the amount of scattered radiation is negligible. With the beam directed vertically into the treatment room floor, it is not possible to detect any radiation in the room above the cobalt unit with the above instruments.

In order to check the total amount of radiation penetrating the treatment room walls over an extended period, several dental x-ray films were placed in critical positions on the outside surface and left in place for ten days. During this time, the size of the treatment field used, the angulation of the beam, and the length of time the beam was "on" were recorded. It was found that the shutter of the machine was open for a total of sixteen hours. Our most recent experience has indicated that for an average eight-hour day of treatments, the shutter of the cobalt unit is open 4.5 hours. The beam was in a more or less horizontal direction for 25 per cent of the sixteen hours, with the remainder of the exposures in a vertical direction. On comparing the films with control films, it was found that none had received 100 mr. Those in the most hazardous positions indicated that the leakage was greatest at these points, as would be expected. Exposures at these positions were 50 to 70 mr. Over this period the field size varied from 36 to 400 sq. cm. Approximately half of the exposures were given with fields whose cross sections were less than 100 sq. cm.

SCATTERED RADIATION INSIDE OF TREATMENT ROOM

Measurements of the amount of scattered radiation inside the room were taken with type BD 11 Baldwin ionization chambers and a Victoreen 0.25-r chamber. These chambers were previously calibrated against known radium and x-ray sources of radiation. The results are shown in Table II and Figure 1. The readings indicate that the protection required for the indicated position of the operator is dependent to a great extent on the length of time the machine is used in the vertical position. The effect of field size on the amount of scattered radiation was investigated and the results are shown in Figure 2. Readings of the scattered radiation were taken at a point *a*, 70 cm. perpendicular to the axis of the beam directly opposite the center of the phantom. It is evident that there is approximately a fivefold increase over the range of field sizes available. The effect of phantom size on the amount of scattered radiation is indicated in Figure 2. Increasing the lateral dimension of the phantom from 25 to 50 cm. decreases the amount of scattered radiation at the position *a* in Figure 1 by approximately 15 per cent. The effect of dose rate on amount of scattered radiation is evident on considering the results obtained by decreasing the F.S.D. from 100 to 70 cm. This results in doubling the dose rate, and from Figure 2 it is apparent that the amount of scattered radiation for a given field size is increased by 50 to 60 per cent.

CONCLUSIONS

Since the amount of radiation penetrating the beam unit head is less than tolerance, it is necessary to protect against scattered radiation only. From the above measurements, we can draw the following conclusions as to the protection required for scattered radiation.

There is a distinct advantage in having the treatment door included in some maze arrangement. If this door is included in one of the thick concrete walls, the amount

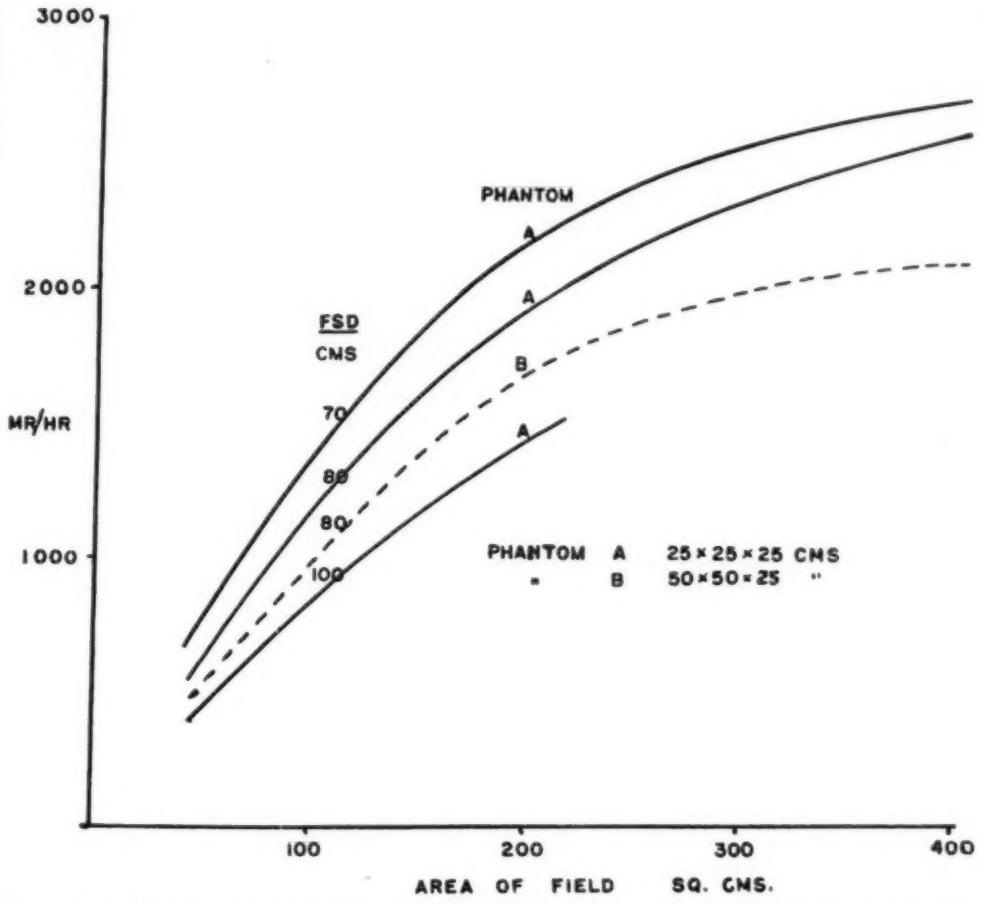

Fig. 2. Variation of scattered radiation, at a point 70 cm. perpendicular to beam and opposite center of phantom, with F.S.D. and size of phantom.

of lead required to give sufficient protection would necessitate some elaborate mechanical system for operation of the door. In the position indicated in Figure 1, the door does not require more than 1/8 inch additional lead protection and possibly 1/16 inch would be sufficient. There is no problem in hanging a door lined with this amount of lead.

The above measurements indicate that it is feasible to build walls of the required thickness with solid concrete or brick blocks.

From values of scattered radiation inside and outside the room, with beam in vertical position, it is evident that 8 1/2 inches of concrete reduces 90° scattered radiation by a factor of 32 or 5 h.v.l. Thus, the h.v.l. for 90° scattered radiation is 1.7 inches. At position A (Fig. 1) the radiation has been scattered through an angle of 45° by the phantom. Considering the radiation to be striking the wall at this angle, the h.v.l. for this scattered radiation is approximately 2.6 inches of concrete, since the radiation path in the wall is 12 inches and the reduction factor is 23.

From measurements taken before and after the lead panel was placed in front of the operator, we can conclude that the h.v.l. for 90° scattered radiation is approximately 1/8 inch lead.

For practical purposes, the amount of scattered radiation for a given phantom

size and dose rate is very nearly directly proportional to the size of the field up to an area of 200 sq. cm.

DISCUSSION

The h.v.l. obtained for 90° scattered radiation agrees very well with that obtained by Dixon when allowance is made for the difference in density of concrete. The h.v.l. for 45° scattered radiation is approximately 10 per cent higher than that obtained by Dixon.

In determining the amount of concrete required to reduce the scattered radiation to the required level, it is evident that consideration should be given to the angle at which the radiation strikes the wall. For example: if 45° scattered radiation is incident perpendicularly to a wall and a reduction factor of 23 is required, it will be necessary to make the wall 4.5 h.v.l. or 11.5 inches thick. It is evident, however, that if this radiation strikes the wall at a 45° angle, the same reduction is obtained by 8.5 inches.

In determining the protection against 90° scattered radiation, consideration should be given to the methods of treatment. If the equipment is used mainly for small-field (100 sq. cm.), beam-directed treatments, it is possible that the level of radiation inside the room may be only half as much as that realized when large fields are used. If the machine is used at varying F.S.D.'s the average dose rate will have to be determined in order to arrive at the most economical protection.

To determine the amount of protection required in the ceiling of the treatment room, several factors should be considered. Scattered radiation penetrates the ceiling in an appreciable amount only when a large beam is pointed in a horizontal direction. By estimating the length of time a large beam would be used in this position, it would be possible to determine how large a reduction factor is required. Our experience has been that only a beam less than 100 sq. cm. is used in a horizontal direction. If large-field treatments are used, the beam is usually directed vertically into the floor. This means that the amount of radiation scattered through 90° toward the ceiling would be only half the rate indicated in Figure 1. In view of the fact that the beam is in this direction for only half of the treatments in an average day, the amount of scattered radiation for which we have to provide adequate protection would be only a third of the amount indicated in Figure 1. This results in a corresponding decrease in the reduction factor and a much more economical determination of the required protection.

The feasibility of making these economies is maintained by results obtained with our monitoring films. These films have demonstrated a leakage well below tolerance over an average week of treatments as well as indicating that none of the staff associated with the unit have received a measurable amount of radiation.

In the permanent installation, the wall in front of operator will be increased to 12 inches to eliminate lead panel and allow for a stronger source.

SUMMARY

The amount of scattered radiation inside and outside a 1,000 curie cobalt^{60} teletherapy room has been determined under various treatment conditions. The effect of dose rate, field size, and size of phantom have been determined. The length of time the shutter of the machine is open and its effect on the amount of radiation outside the room is discussed. The variation of h.v.l. of the scattered radiation with the angle of scattering is determined. A discussion of how economies may be realized is included.

ACKNOWLEDGMENTS: The author wishes to thank Dr. L. B. Leppard, Ontario Department of Health, and Mr. P. Bird, National Department of Health and Welfare, for their advice and assistance in the above measurements.

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SUMARIO

Observaciones de la Radiación Dispersa Dentro y Fuera de un Cuarto de Teleterapia con Cobalto^{60} de 1,000 Curies

Hiciéronse mediciones de la cantidad de rayos dispersos alrededor de un aparato de cobalto^{60} de 1,000 curies en condiciones de tratamiento. Vista la posibilidad de que el aparato funcione durante un período de tiempo que mantenga el obturador abierto ocho horas diarias, se calculó sobre esa base la protección requerida.

Los factores que intervienen en la determinación de la cantidad de protección necesaria para funcionamiento inocuo comprenden el ángulo de incidencia del haz de rayos; las técnicas de tratamiento, ya sea con campos grandes o pequeños; la dosis; y el tiempo que permanece abierto el obturador. Demuéstrase que, tomando esos factores encu enta, cabe efectuar economías considerables.

Thyroid Gland Weight Determination from Thyroid Scintigrams with Postmortem Verification[1]

WILLIAM E. GOODWIN, M.D., BENEDICT CASSEN, PH.D., and FRANZ K. BAUER, M.D.

THE DETERMINATION of the weight of the human thyroid gland has become extremely important since the introduction of I^{131} in the treatment of hyperthyroidism. In most clinics estimates of the weight of the gland are obtained by palpation, which at best is a crude procedure. Allen and Goodwin (1) have recently described a more accurate method.

The point-by-point technic of plotting the frontal area occupied by the thyroid gland used by Allen, Libby, and Cassen (2) has been simplified by the introduction of the "scintiscanner" (3, 4) for obtaining an actual size scintigram of the gland. The formula presented by Allen and Goodwin can be readily applied to measurements obtained from a scintigram. In the Wadsworth General Hospital (Los Angeles) this procedure has become routine in the determination of dosages of I^{131} for the treatment of hyperthyroidism and intractable heart disease (5). As the constant in the formula of Allen and Goodwin was obtained from a very limited series of autopsy and surgical material, it seemed of importance to amplify these data with any new specimens that became available.

In several cases of intractable heart disease recently treated with I^{131} in this hospital, scintigrams (3, 4) were made prior to therapy in order to calculate the dose of the isotope. In 4 such cases we had the opportunity of obtaining the entire thyroid glands: 3 glands were obtained postmortem and 1 very large thyroid was removed surgically for non-toxic goiter. The morphological characteristics of these thyroid glands and their actual weight could thus be compared with the estimated weight derived from the scintigram obtained prior to death or operation.

In this series of cases the doses of I^{131} administered were in the range of 250 microcuries, which is not sufficient to cause morphologic changes, particularly in the few days which had elapsed between obtaining the scintigram and the death of the patient or operation.

METHOD

A detailed description of the scanning mechanism and procedure for making the scintigram has been previously presented (3). After obtaining a scintigram, the outer margin of the thyroid gland is drawn. It has been found that with a little practice this can be done in a consistent and reproducible manner. A planimeter is then used to measure the surface area, the measurement being expressed in square centimeters. The longest dimension of the lobe is measured in centimeters. The area and length thus obtained can be used in the weight formula of Allen and Goodwin. If the lobes are asymmetrical, the mean length of the two lobes is used in the formula. The additional data presented in this report support the original factor of 0.32 used by Allen and Goodwin for the estimation of gland weight. A more detailed discussion of the nature of weight estimation formulae is presented below.

GEOMETRICAL CONSIDERATIONS OF WEIGHT FORMULAE

Two shapes are called geometrically similar if, by changing all linear dimensions of one by a common factor, it can be made congruent to the other. When the linear dimensions are changed by a factor, say r, all areas associated with the surface of the shape will change by the factor r^2 and the total volume or corresponding subvolumes will change by the factor r^3.

If, as a first approximation, it is assumed

[1] From the Radioisotope Unit, Wadsworth General Hospital, Veterans Administration Center, Los Angeles, Calif., and the Departments of Medicine, Biophysics, and Radiology, School of Medicine, University of California at Los Angeles. Accepted for publication in August 1952.

that the lobes of thyroid glands from different patients, including diffusely enlarged thyroid glands, are geometrically similar, the volume of the gland could then be expressed as $V = CL^3$, where L is a measured linear dimension, such as the overall length of a lobe, and C is a "shape"

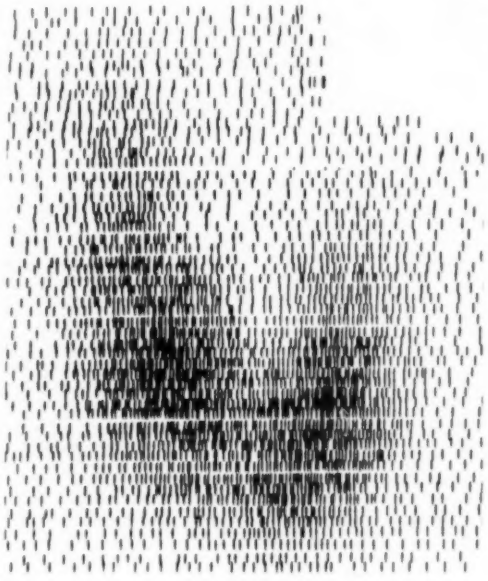

Fig. 1. Case I. Scintigram of thyroid gland. Surface area 33.5 sq. cm. Height: left lobe 8.6 cm., right lobe 6.9 cm., mean 7.8 cm.

factor which can be experimentally determined for the particular shape involved. This method is not very accurate, as a small error in L will make a larger error in V. For example, if L is in error by 10 per cent, then V will be in error by 33 per cent.

From a thyroid scintigram not only can a length L be measured, but an area, A, the projected frontal area, can be directly determined. Then, after determination of suitable shape factors for each case, it becomes possible to express the volume of the lobe in any of the following combinations, each of which has the dimensions of a volume:

$$V = CL^3$$
$$V = C_1L^5/A, \text{ etc.}$$
$$V = KAL$$
$$V = K_1A^2/L, \text{ etc.}$$

Fig. 2. Case II. Photograph of thyroid gland.

Obviously the formula $V = KAL$ is preferable for accuracy, as this is the only one in which each of the directly measured quantities appears as only the first power.

The principle of geometrical similarity of thyroid glands is only an approximation. It is likely that some glands are long and slender, while others are short and oblate. It would be possible to apply a "form factor" correction depending on the ratio of length to width. So far, this has not been found necessary, as reasonable and useful results have been obtained by using the formula $V = KAL$ where K is about 0.32 as determined by Allen and Goodwin. A is in square centimeters and L in centimeters when this value of K is used. Strictly, the weight of the gland in grams is equal to its volume in cubic centimeters multiplied by its specific gravity. For the degree of accuracy here involved, the specific gravity can be considered as unity. The formula as developed by Allen and Goodwin is expressable as follows: The weight of the gland in grams is equal to $0.32 \times$ the area of the scintigram in square centimeters $\times$ the maximum length of the lobe in centimeters.

CASE I: H. H., a 54-year-old salesman, was admitted to the hospital for paroxysmal ventricular tachycardia. In the course of his hospitalization a complete thyroid work-up was advised in an effort to exclude any extraneous source of myocardial irritability. A scintigram was made of the frontal

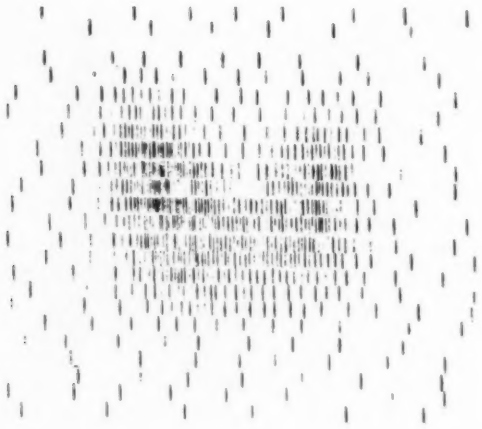

Fig. 3. Case II. Scintigram of thyroid gland. Surface area 15.8 sq. cm. Height: left lobe 4.5 cm., right lobe 3.5 cm., mean 4.1 cm.

profile of the thyroid gland (Fig. 1). By palpation the gland was estimated to be of normal size. The scintigram, however, showed it to be extremely large. The I^{131} was found to be diffusely dispersed throughout the thyroid with no areas of increased or decreased concentration. In September 1951, two weeks after the scintigram was made, the patient had a recurrence of ventricular arrhythmia and died suddenly. The thyroid gland was obtained postmortem and the actual weight determined to be 104 grams. The estimated weight from the scintigram was 114 grams.

CASE II: J. M., a 62-year-old store clerk, was referred to the Radioisotope Clinic with the diagnoses of diffuse thyrotoxicosis and arteriosclerotic heart disease with angina pectoris. It was the decision of the Radioisotope Board that the thyrotoxicosis be treated with I^{131}. Seven days after therapy, during an uneventful post-therapeutic course, the patient complained of a severe pain in the chest and died.

The actual weight of the thyroid gland obtained at postmortem examination was 19.29 grams. The estimated weight derived from the scintigram (Fig. 3) was 20.28 grams. Figure 2 is a picture of the thyroid gland in a simulated position in the neck.

CASE III: L. K., a 55-year-old Negro mail carrier, gave a history of heart disease of undetermined etiology, with congestive failure and attacks of ventricular tachycardia. In view of the intractability of the heart failure, the Radioisotope Board recommended medical ablation of the thyroid gland by means of I^{131}. Treatment was carried out in February 1952. In March 1952, fifteen days subsequent to therapy, after a series of pulmonary emboli, the patient suddenly died.

The estimated weight of the thyroid gland obtained from the scintigram (Fig. 5) was 25.3 grams. The actual weight of the thyroid postmortem was 24.3 grams. Figure 4 is a picture of the thyroid gland, thyroid cartilage, and trachea intact.

CASE IV: L. D., a 24-year-old laborer, entered

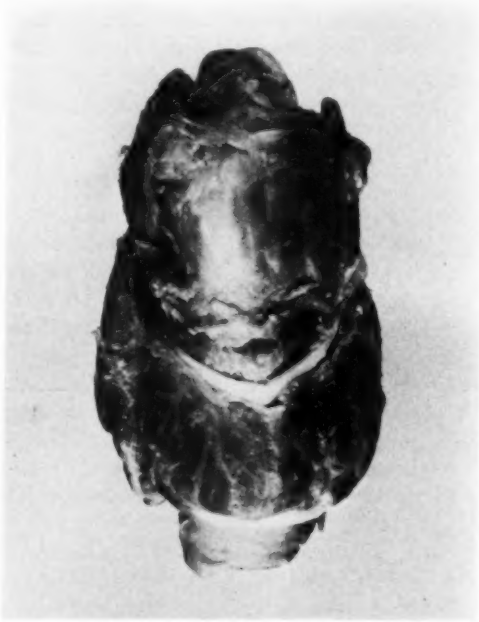

Fig. 4. Case III. Photograph of larynx, thyroid gland, and trachea. A border of cotton for contrast separates thyroid gland from the larynx and trachea.

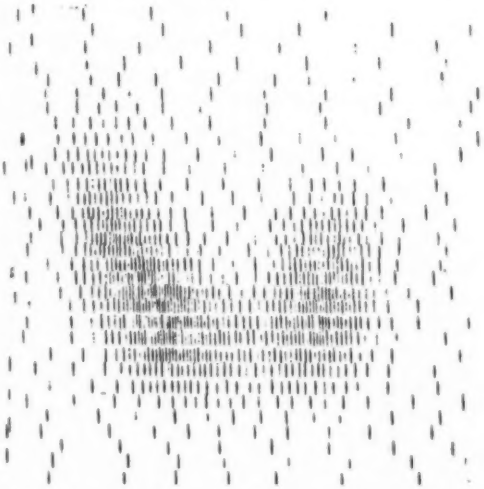

Fig. 5. Case III. Scintigram of thyroid gland. Surface area 16.1 sq. cm. Height: left lobe 4.0 cm., right lobe 5.5 cm., mean 4.8 cm.

the hospital following a motorcycle accident in which he incurred a fracture of the right scapula. He showed no other signs or symptoms except a large thyroid gland.

A scintigram (Fig. 7) was made, and on the basis of the frontal profile of the gland, its weight was

Fig. 6. Case IV. Photograph of thyroid gland. Note the isolated nodule in the superior pole of the left lobe.

estimated to be 107 grams. The area of lesser density in the left superior pole of the scintigram represents the nodule in the operative specimen (Fig. 6). In November 1951, a right total and left subtotal thyroidectomy was performed. Approximately 10 grams of thyroid tissue were left. The actual weight of the removed thyroid gland was 99.5 grams. This figure includes 10 grams estimated to be left in the neck at operation.

DISCUSSION

In the calculation of a single therapeutic dose of I^{131}, several factors have to be taken into account (6): (*a*) the estimated amount of radiation (rep) to be delivered to the gland, (*b*) the maximum uptake of the administered dose of I^{131} by the gland, (*c*) the effective half-life, (*d*) the weight of the gland. Because of the fact that, until very recently (1), the thyroid gland weight had to be estimated by palpation, any accurate calculation of a therapeutic dose of I^{131} was extremely difficult, if not impossible.

The series of cases reported here is small because of the inherent difficulty of obtaining scintigrams of patients just before death. Often the death of the patient is quite unexpected, and useful scintigrams for correlating with necropsy material are obtained only as a matter of chance. The greatest error in estimating the thyroid weight in this series (Table I) and the one previously published by Allen and Goodwin (1) was 25 per cent, with a mean error of 8.4 per cent.

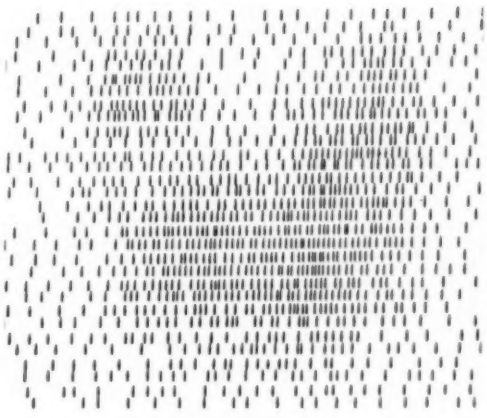

Fig. 7. Case IV. Scintigram of thyroid gland. Note the area of lesser density in the superior pole of the left lobe, corresponding to the isolated node in Fig. 6. Surface area 6.6 sq. cm. Height: left lobe 7.7 cm., right lobe 8.1 cm., mean 7.8 cm.

TABLE I: ESTIMATED AND ACTUAL WEIGHTS, WITH THE PER CENT ERROR, FOR THE FOUR CASES PRESENTED

Case No.	Estimated Weight (gm.)	Actual Weight (gm.)	% Error
I	114.0	104.0	+8.7
II	20.3	19.29	+5.0
III	25.0	24.3	+2.8
IV	107.0	99.5*	+7.2
		Average % Error—	5.9

* This value includes the estimated 10 gm. not removed at surgery.

SUMMARY

The weight of the thyroid glands of four patients was calculated from thyroid scintigrams by a method used routinely on patients to be treated with therapeutic doses of I^{131}. Three of these patients subsequently died of heart disease, and one underwent thyroidectomy. The actual weight of these specimens agreed well with the weight determined from the thyroid scintigrams, thereby giving additional support to the validity of the method.

ACKNOWLEDGMENTS: The authors wish to express their thanks to Elsie Youtcheff, B.A., and Lucille Shoop, R.N., for technical assistance, and to Dr. Raymond L. Libby for review of the manuscript.

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SUMARIO

Determinaciones del Peso del Tiroides por Escintigramas Tiroideos con Comprobación en la Autopsia

En varios casos de cardiopatía incoercible que iban a ser tratados con I^{131}, se determinó el peso del tiroides por medio de "escintigramas," usando para ello una fórmula elaborada por Allen y Goodwin. De acuerdo con esa fórmula, el peso de la glándula en gramos equivale a 0.32 × el área del escintigrama en centímetros cuadrados × la longitud máxima del lóbulo en centímetros. En 4 casos en que se pudo conseguir el tiroides después para medición (3 en la autopsia y 1 en la operación), el error mayor en el cálculo representó 25 por ciento y el error medio 8.4 por ciento.

The *n* Unit and Energy Absorption in Tissue[1]

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WHEN FAST NEUTRONS were first employed for irradiating biological material more than ten years ago, it was apparent that the choice of a unit was a difficult problem. It was realized at the outset that the best basis of comparison with x- or gamma radiation was energy absorption in tissue. A determination of this quantity, however, was not practicable especially in routine measurements, and for that reason a more convenient unit was needed. In 1942 Aebersold and Lawrence (1) introduced the *n* unit, which represents the quantity of neutron radiation that will produce the same ionization in a 100-r Victoreen chamber as 1 roentgen of x-radiation. The *n* unit has since been used extensively to quantitate neutron exposures of biological material, although it suffers from a number of limitations. Among these is the fact that the unit is arbitrary in the sense that the factor relating the response of the ionization chamber to energy absorbed in tissue depends on a number of complex variables, most of which depend on neutron energy. Examples of these are: relative interaction cross sections for neutrons; stopping power, relative to air, of the wall material of the chamber for the recoil nuclei produced; the ratio of energy loss and ionization for these nuclei; and corrections for the fact that the chamber dimensions may be comparable to the range of the ionizing particles. Aebersold and Anslow (2), taking into account these and other factors, came to the conclusion that tissues exposed to 1 n of fast neutrons receive between 1.98 and 2.5 times as much energy as when exposed to 1 r of hard x-rays.

Another difficulty lies in the fact that Victoreen chambers are not designed for the measurement of fast neutrons. Consequently, they may show considerable variation in response. This may be due to such factors as difference of wall thickness, variation in the thickness of the interior conducting coating, and inequality of dimensions of the sensitive volume. As a result, two chambers having equal sensitivity to x-rays may exhibit appreciable differences when exposed to neutrons.

In the absence of better, readily available, reference standards, these chambers have been used in spite of the above-mentioned drawbacks. It is therefore a matter of interest to obtain further information on the energy absorbed by tissue exposed to 1 n of fast neutrons and on the likely limits of variation of this quantity caused by inherent differences between Victoreen chambers.

In the following are reported the results of the calibrations of a number of Victoreen chambers at two neutron sources. While the actual figures apply, of course, only to the actual conditions of this study, they have general applicability, since the sources employed are typical and because the variations in chamber response suggest limits within which the *n* unit is likely to be a consistent basis for comparison.

Measurement of Tissue Dose: The tissue dose was determined with tissue equivalent ionization chambers (3). One chamber is lined with a gel and simulates tissue of the following atomic composition:

Hydrogen	9.7%
Oxygen	71.0%
Carbon	15.8%
Nitrogen	3.5%

The other chamber is lined with a conducting plastic composed of:

Hydrogen	10.1%
Oxygen	3.5%
Carbon	82.7%
Nitrogen	3.7%

[1] From the Radiological Research Laboratory, Columbia University, New York, N. Y. Accepted for publication in August 1952.
This paper is based on work done under Contract AT-30-1-GEN-70 for the U. S. Atomic Energy Commission.

Both chambers contain gas mixtures identical in composition to that in the respective walls.

Previous tests (4) have shown that the response of these chambers is in the ratio of their hydrogen content, *i.e.*, 1.04, for neutrons of energies between 0.5 and 14 mev. As may be expected on theoretical grounds, the replacement of oxygen by an equal weight of carbon has little effect on chamber response.[2] In the experiments reported here the ratio between these two tissue-equivalent chambers was also 1.04 within less than 1.0 per cent.

In the following, all figures will apply to the higher hydrogen content (10.1 per cent). It will be apparent from the preceding that the dose received by other tissues will be proportional to their relative hydrogen content as compared with the above figure, at least within the range commonly encountered in soft tissues. This will be true regardless of the relative percentages of oxygen and carbon. On theoretical grounds, nitrogen content may also be considered unimportant within the limits likely to exist in tissue (5) as long as the neutron energy is in excess of 0.5 mev. The same applies to any other elements occurring to the extent of a few per cent.

Tissue doses are given in reps. One rep is understood to correspond to the absorption of 93 ergs per gram of tissue.

The chambers were calibrated with 250-kv. x-rays, and the response was checked both before and after the neutron calibrations. Allowance was made for a 10 per cent difference in response of the chambers to x-rays and neutrons. This difference is due to the fact that W, the average energy expended in the production of an ion pair, is 10 per cent less for the electrons generated by the electromagnetic radiation.

Victoreen Chambers: Four sets of Victoreen chambers (A, B, C, and D) were calibrated. Each set consisted of a 25-r and a 100-r chamber. With the exception of the B series—which was measured on the same instrument as the C series—each chamber was read with the condenser meter normally provided. This was done both at a cross check at which the relative x-ray sensitivity of the chambers was determined (at 250 kv.) and at the neutron measurements.

An absolute calibration of two chambers (C-25 and C-100) was performed by means of a standard free-air chamber. This, in conjunction with the cross check, made it possible to obtain the absolute x-ray sensitivity of all chambers.

Neutron Sources: One of the sources was the beryllium target of a 33-inch cyclotron. The neutrons were produced by bombardment with deuterons of approximately 9.5 mev energy. Since the reaction is exothermic with a Q of about 4 mev, the maximum neutron energy was about 13.5 mev. The chambers were exposed in a housing used for animal exposures. This enclosure is surrounded by 2 inches of lead at all sides except at the front, where the thickness is 4 inches.

The other source emitted fast neutrons with a spectrum characteristic of fission of U^{235}. This distribution was somewhat modified by the extensive shielding designed to suppress slow neutrons and gamma rays.

Gamma Radiation: A Victoreen chamber will register a reading of 1.0 when exposed to 1 rep of gamma rays. Therefore, exposure of such a chamber to a mixed beam of gamma and neutron radiation will result in a number of reps per division which depends on the relative amount of gamma radiation present. This number approaches 1 if the gamma radiation predominates. Thus, a determination of the tissue dose corresponding to the n requires minimal admixture of gamma radiation in the neutron beam. This requirement was largely met at both neutron sources, since efforts had been made to suppress gamma radiation as much as practicable because of the objectives of the biological experiments in progress.

Information on the fraction of the dose

[2] It may be well to point out that this is not equivalent to the statement that the contribution of either of these elements is negligible. In fact, this response is likely to be appreciable (see below).

contributed by gamma radiation was obtained by two methods. One of these consisted in the use of an ionization chamber lined with graphite and filled with CO_2. The response of this device to x-rays and gamma rays is very nearly proportional to the number of roentgens received. The response to neutrons is low. It is not zero, however, and for this reason the readings obtained represent an upper limit to the amount of gamma radiation that may have been present. At the cyclotron this limit was found to be about 0.2 r per rep, and at exposures to the fission spectrum about 0.25 r per rep.

To get information on gamma contamination, film badges were exposed in a number of determinations. These films were calibrated against a radium source, and their response to gamma radiation in excess of 200 kev was presumably the same. The sensitivity to fast neutrons may be considered negligible. The amount of gamma radiation indicated is about 0.07 r per rep for the fission neutrons. These figures suggest that between one-half and two-thirds of the reading registered by the carbon chamber is due to neutrons. This is in agreement with previous measurements (4) giving a minimum response of about 15 per cent when the chamber was exposed to various neutron sources.

Because of the small amount of gamma radiation present, the data obtained may be considered to represent substantially the response of these Victoreen chambers to a "pure" neutron beam. The relative gamma dose of 7 per cent lowers the number of reps per n by 3.5 per cent from the value which would be obtained under total absence of gamma radiation.

Accuracy: Two factors limit the accuracy of the figures presented. One is the fact that the sensitivity of the tissue-equivalent chambers was comparatively high, somewhat higher than the sensitivity of the 25-r chambers. As a result, 100-r chambers had to be employed over less than 25 per cent of their useful range, which tended to lower the precision with which they could be read. Another source of uncertainty was that there was a marked change of radiation intensity in the lead enclosure at the cyclotron. While a record of chamber positions was kept and the data were corrected for the position effect, it seems possible that an error of about ±5 per cent remained.

TABLE I: RESPONSE OF VICTOREEN CHAMBERS TO X-RAYS AND NEUTRONS*

(Rep for tissue of 10.1 per cent hydrogen content)

	Div/r X-Ray	Rep/-div Cyclotron	Rep/n† Cyclotron	Rep/-div Fission	Rep/n† Fission
		25-r Chambers			
A	0.95	1.85	1.76	..	..
B	0.98	2.00	2.04	2.05	2.00
C	1.00	2.00	2.00	2.00	1.99
D	1.07	..	..	1.77	1.89
		100-r Chambers			
A	0.94	2.11	1.97	..	..
B	0.99	1.86	1.93	2.06	2.04
C	1.01	1.92	1.94	1.86	1.87
D	1.10	..	..	1.61	1.77

* All sensitivities are corrected to N.T.P.

† These figures are the product of the values given in div/r and rep/div columns. They indicate the number of reps of neutron radiation required to produce the same deflection as one roentgen of x-rays.

From the deviations observed, the limits of error for the fission neutrons are estimated to be ±2 per cent for 25-r chambers and ±5 per cent for the 100-r chambers. For data obtained at the cyclotron the corresponding figures are ±5 per cent and ±7 per cent.

RESULTS AND DISCUSSION

Table I gives the results of the calibrations performed. It will be noted that the chambers of the A series were exposed at the cyclotron only, and the chambers of the D series at the source of fission particles only, while chambers of the B and C series were calibrated at both locations. The table shows that the response of different Victoreen chambers to neutron radiation varies because of two factors. The first is the fact that the x-ray response of chambers can differ (Column I). While this source of error can obviously be remedied by proper x-ray calibration, it is evident that omission of such a calibration may lead to a considerable discrepancy (Columns 2 and 4). However, even if the

difference in x-ray response is allowed for, there remains an intrinsic difference in neutron sensitivity which is of the order of 15 per cent (Columns 3 and 5). The average response of all 25-r chambers in all measurements is 1.95 rep/n, while the corresponding figure for the 100-r chambers is 1.92 rep/n. While the difference is in the direction expected (lower sensitivity of the 25-r chamber because of a larger cavity), it is too small to be significant as far as these measurements are concerned.

While detailed information on either neutron spectrum reaching the chambers was not available, it is evident that the average neutron energy was considerably lower in the case of the fission neutrons. Since for the chambers exposed to both sources, the number of reps per n was the same in either case (within experimental error), it would appear that the *n* unit is energy-independent over a range of neutron energies.[3]

[3] One of the 25 r chambers (C) used in this work was recently exposed in the course of a third calibration. This involved a source (beryllium bombarded by protons) emitting neutrons of lower energy than either of the above mentioned. The value obtained was 2.39 rep/n, indicating an increase of the rep/n ratio at low neutron energies.

In conclusion, it may be well to emphasize once more that the small number of chambers tested does not warrant the conclusion that the figures given here are typical. It is quite possible that different values might be obtained for other Victoreen chambers.

ACKNOWLEDGMENTS: The author is indebted to Dr. G. Failla, who greatly stimulated and encouraged this work, and to Dr. Austin Brues, Dr. Howard Vogel, and Dr. Titus C. Evans, who gave permission to use data obtained. Dr. John W. Clark, Donn L. Jordan, and Dr. T. C. Evans, who assisted in the comparison measurements, Mr. Bernard Dwork, who performed calibrations of the tissue equivalent chambers, and Miss P. McClement who calibrated a 25-r and a 100-r chamber against a standard chamber made available by courtesy of Mr. C. B. Braestrup. Mr. H. Blatz kindly arranged procurement and interpretation of the film badges used.

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SUMARIO

La Unidad n y la Absorción de Energía en el Tejido

Las cámaras Victoreen, aunque magníficos dosímetros para los rayos X, no están destinadas a la medición de neutrones veloces. Sin embargo, a falta de mejores y accesibles patrones de comparación, han sido usadas a pesar de sus desventajas.

Con mira a obtener más información acerca de la energía absorbida por el tejido expuesto a 1 n de neutrones veloces y de los probables límites de variación de dicha cantidad debido a diferencias inherentes entre distintas cámaras Victoreen, el A. calibró varias de éstas en dos focos de neutrones. Un foco fué el blanco (anticátodo) de berilio de un ciclotrón de 84 cm.; el otro emitía neutrones veloces con un espectro típico de fisión de U^{235}.

La respuesta de las diversas cámaras varió, según se observó, debido a dos factores: (1) la diferencia de las cámaras en la respuesta a los rayos X; (2) una diferencia intrínseca de un tenor de 15 por ciento en la sensibilidad de los neutrones. La respuesta media de todas las cámaras de 25 r comprobadas fué de 1.95 rep/n, en tanto que la cifra correspondiente para las cámaras de 100 r fué de 1.92 rep/n.

Parece por este estudio que la unidad n es independiente de la energía presente en una amplia escala de valores de neutrones.

Effects of Acute Whole-Body X-Irradiation on Salt and Water Metabolism and Their Clinical Significance[1]

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RECENT DISCUSSIONS of the treatment of the acute radiation syndrome have emphasized the importance of parenteral fluids for nutrition and for correcting changes in electrolytes and acid-base balance (1, 2). In an effort to gain information on which such therapy might be based, we have compared the distribution and excretion of sodium, potassium, and chloride in rats subjected to acute whole-body irradiation at an LD 50 level and in pair-fed controls. Through the use of pair-fed controls we hoped to demonstrate changes other than those caused by decreased food intake. In addition, we have followed electrolyte concentrations in a radiosensitive, a radioresponsive, and a radioresistant tissue.

EXPERIMENTAL PROCEDURES

Sprague-Dawley male rats, approximately 130 days old and 300 gm. in weight, were held in individual metabolism devices which immobilize the animal and permit accurate separation of urine and feces (Fig. 1). After a control period of four days, the experimental animals were given 660 r acute whole-body x-irradiation, which is around the LD 50/30 days for our laboratory. The factors were 250 kv., 15 ma., 1 mm. Al and 0.5 mm. Cu filtration, and the dose rate was 90 r per minute. The dose was checked with a Victoreen r-meter in a paraffin phantom. The control rats were sham-irradiated for the same period and both sets of animals were offered water *ad libitum*. The irradiated rats were allowed free access to a stock diet, and the controls were pair-fed with them. Urine and feces were collected at 24-hour intervals during the control period and for twelve days after irradiaton. Each 24-hour collection from each rat was analyzed separately for sodium, chloride, and potassium. The results suggested that the most significant time periods for tissue analysis would be 24, 96, and 240 hours after irradiation. Accordingly, 6 irradiated and 6 pair-fed control animals were studied at each of these periods. In order that the animals used for tissue analysis might be strictly comparable with those from the balance study, they also were held in the metabolism devices.

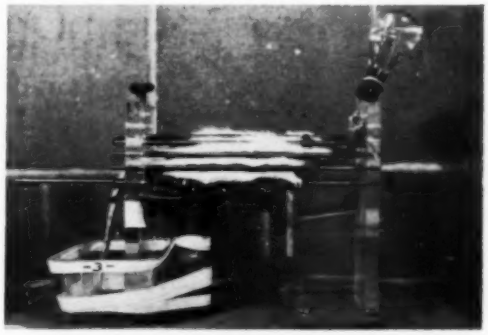

Fig. 1. Immobilization of experimental animal in a metabolism device permitting accurate separation of urine and feces.

After withdrawal of blood by cardiac puncture without anesthesia, the animals were decapitated and tissue samples were removed for analysis. Muscle samples consisted of the entire muscle mass surrounding the femur, liver samples of the entire liver (except in the 24-hour rats), and small intestine samples of the entire small intestine stripped free of contents and of mesenteric fat. The tissue samples from each rat were analyzed separately.

[1] From the Radiobiology Laboratory, University of Utah College of Medicine, Salt Lake City, Utah. Presented at the Thirty-eighth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, Dec. 7–12, 1952.

This work was performed under contract No. AT(11-1)-119 with the Atomic Energy Commission.

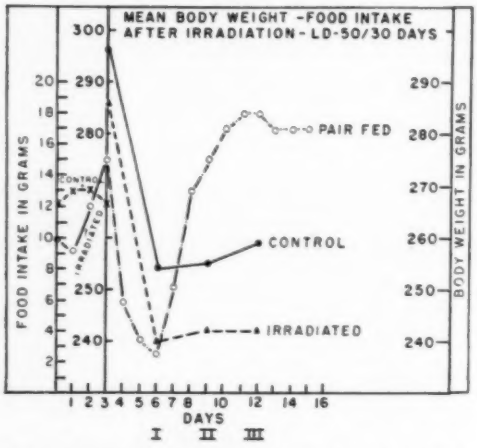

Fig. 2. Changes in food intake and weight in 6 irradiated animals and 6 pair-fed controls.

Water content was determined by drying weighed tissues and aliquots of blood plasma at 105° C. to constant weight. The dried tissues or feces were pulverized, and aliquots of all samples, prepared by the method of Hald (3), were analyzed for sodium and potassium by means of a Perkin-Elmer flame photometer using lithium as an internal standard. Chloride was determined in plasma and urine by the method of Schales and Schales (4), and in tissue and feces by that of Van Slyke and Sendroy (5). The tissues were analyzed for fat by multiple extraction of separate aliquots with ethyl ether (6) and the values obtained were used in correcting those for water and electrolytes to a fat-free basis.

RESULTS AND DISCUSSION

Immediately after irradiation the rats showed a decrease in food intake. Water intake decreased less sharply, and although water was offered *ad libitum* to both irradiated and control groups, there was no significant difference between the two with regard to water consumption. There was approximately the same degree of weight loss in the irradiated rats and the pair-fed controls, and both groups failed to show any significant gain in weight after the initial loss. Figure 2 depicts the changes in food intake and weight in 6 irradiated animals and 6 pair-fed controls.

For the first three days after irradiation there was a negative balance of Na, K, and Cl; that is, more was lost in the combined urine and feces than was consumed in the food. However, since this occurred in the control rats also, it appeared to be a result of the suddenly reduced food intake rather than of irradiation. The percentage of the total output of Na, K, and Cl which was found in the feces was the same in irradiated and control animals, except that the irradiated rats lost more Na and K in the feces on the fourth to the eighth day after irradiation. At this time, however, there was a compensatory decrease in the urinary excretion of Na and K. Table I shows the differences in total daily output of Na, K, and Cl between 6 irradiated and 6 control rats. Because of the wide scatter of the data from individual rats, none of the differences is statistically significant.

TABLE I: SODIUM (Na), POTASSIUM (K), AND CHLORIDE (Cl) IN URINE AND FECES OF IRRADIATED RATS
(Values per rat per day difference from controls)

Days Before Irradiation	Na (mEq)	K (mEq)	Cl (mEq)
4	−0.10	+0.03	+0.45
3	+0.04	0.00	−0.22
2	−0.11	−0.23	−0.64
1	−0.20	+0.26	0.00
Days After Irradiation			
1	−0.09	−0.04	−0.03
2	+0.24	+0.04	−0.34
3	−0.17	+0.05	−0.23
4	−0.31	−0.13	+0.29
5	+0.50	−0.15	+0.28
6	−0.16	−0.13	−0.30
7	−0.17	+0.06	−0.04
8	+0.15	0.00	+0.23
9	−0.35	+0.14	+0.05
10	+0.12	+0.18	−0.15
11	−0.03	+0.13	+0.33
12	−0.41	+0.10	−0.15

\+ lost more than pair-fed controls.
− lost less than pair-fed controls.

The findings on tissue analysis, including blood plasma, at 24, 96, and 240 hours after irradiation are listed in Table II. Small intestine of the irradiated animals showed a loss of potassium and gains in sodium and chloride at 24 hours when com-

TABLE II: EFFECTS OF ACUTE WHOLE-BODY IRRADIATION ON ELECTROLYTES OF RAT BLOOD PLASMA AND TISSUES
(Values per kilogram wet weight. Tissue values on fat-free basis)

Hours After Irradiation	H_2O (gm.)	Na (mEq)	K (mEq)	Cl (mEq)
		Blood Plasma		
24: Control	911 ± 2.3	144.0 ± 1.04	4.5 ± 0.23	107.0 ± 1.00
24: Irrad.	914 ± 1.5	143.8 ± 0.79	4.4 ± 0.01	107.0 ± 1.54
96: Control	920 ± 1.6	144.3 ± 1.35	4.2 ± 0.15	105.6 ± 0.65
96: Irrad.	922 ± 1.6	144.9 ± 1.23	4.7 ± 0.38	105.7 ± 0.63
240: Control	920 ± 2.1	142.3 ± 1.21	4.5 ± 0.23	106.4 ± 0.70
240: Irrad.	923 ± 1.3	143.8 ± 2.00	4.6 ± 0.33	108.1 ± 0.95
		Muscle		
24: Control	765 ± 4.3	23.8 ± 0.90	104.7 ± 2.11	13.6 ± 0.87
24: Irrad.	764 ± 3.5	23.8 ± 1.20	104.3 ± 2.50	15.2 ± 0.94
96: Control	771 ± 1.1	20.3 ± 0.59	105.1 ± 0.91	12.3 ± 0.31
96: Irrad.	776 ± 4.1	23.7 ± 2.03	101.3 ± 3.28	14.6 ± 1.32
240: Control	777 ± 4.5	26.6 ± 1.94	88.6 ± 3.33	16.4 ± 1.54
240: Irrad.	770 ± 2.4	24.2 ± 0.70	89.0 ± 3.23	15.3 ± 0.65
		Small Intestine		
24: Control	774 ± 1.9	48.6 ± 1.03	97.2 ± 1.74	42.1 ± 1.12
24: Irrad.	780 ± 3.3	57.8 ± 0.89*	89.8 ± 1.99*	47.7 ± 0.84*
96: Control	794 ± 1.3	51.7 ± 1.01	92.0 ± 1.20	44.3 ± 0.57
96: Irrad.	796 ± 2.6	50.6 ± 1.82	91.8 ± 1.07	42.6 ± 1.11
240: Control	797 ± 4.9	51.1 ± 1.13	90.9 ± 1.51	42.5 ± 1.65
240: Irrad.	797 ± 2.2	52.3 ± 1.45	92.1 ± 0.83	43.9 ± 0.40
		Liver		
24: Control	721 ± 4.5	28.9 ± 0.73	88.7 ± 1.27	30.9 ± 0.91
24: Irrad.	733 ± 4.5	29.8 ± 1.03	96.5 ± 1.35*	31.7 ± 0.86
96: Control	722 ± 1.9	30.8 ± 0.56	93.3 ± 0.95	30.1 ± 0.56
96: Irrad.	721 ± 1.6	28.2 ± 1.34	94.6 ± 1.32	27.6 ± 1.17
240: Control	721 ± 4.8	30.5 ± 0.76	90.9 ± 1.22	26.3 ± 1.08
240: Irrad.	719 ± 3.6	29.8 ± 0.60	94.7 ± 1.09	24.2 ± 0.93

* Value of P is 0.01 or less by the t test. In all other cases value of P is over 0.05.

pared with the control animals. Liver from irradiated animals showed an increase in potassium over the pair-fed controls at 24 hours. There were no other significant differences between the tissues or blood of the irradiated animals and the pair-fed controls.

Food Intake: Gustafson and Koletsky (7) have reported a 7 per cent greater weight loss in rats receiving 660 r acute whole-body irradiation than in pair-fed controls. The slight difference in our findings may be accounted for by the fact that our animals were immobilized while Gustafson's animals were placed in conventional metabolism cages. The results of both experiments emphasize the significance of decreased food intake in the weight loss that follows acute whole-body irradiation injury.

Balance Studies: In earlier studies, one of us reported increased urinary and fecal excretion of radiopotassium after acute whole-body irradiation above an LD 50 level in animals fed *ad libitum*. Radiosodium excretion in the feces was increased at the height of the post-irradiation diarrhea, while urinary levels were decreased (8, 9). Studies with radioactive isotopes, however, do not necessarily represent the whole situation in regard to balances of these electrolytes, and accordingly in the present studies the excreta were analyzed for total electrolyte content. Caster (10) compared electrolyte balances in rats receiving an LD 50 of acute whole-body irradiation and in controls fed *ad libitum*. He found that during the first four days after irradiation the experimental animals showed a negative potassium balance and, to a lesser degree, a negative sodium balance. The lack of any statistically significant differences in the electrolyte balances of the irradiated animals and the pair-fed

controls emphasizes the role of decreased food intake in producing the losses of potassium and sodium reported by Caster.

Blood Electrolytes: A variety of alterations in plasma and serum levels of sodium, chloride, and potassium have been reported after acute whole-body irradiation injury. Kohn (11) and Bennett *et al.* (12) have reported increases in plasma or serum sodium of 3 to 8 mEq in rats at three to four days after an acute LD 50. Soberman *et al.* (13) were unable to detect any significant changes in plasma sodium or potassium levels in the dog after an acute LD 50 exposure. After abdominal irradiation of the dog at 1,400 to 2,800 r, Moon and his associates (14) found an increase in blood potassium content. In a recent study of the acute radiation syndrome in man (15), one patient who was estimated to have received a whole-body exposure of over 2,000 r showed an early decrease in serum sodium and a late decrease in serum chloride. Since this individual suffered extensive and severe radiation burns, the decreases in salt may have been occasioned by losses into the edematous burned areas.

In view of the selectivity of the tissue injury, the ability of the kidneys to excrete the potassium moving out of these tissues, and the absence of associated changes in acid-base balance in our experiments (16), it is not surprising that there were no significant changes in plasma potassium levels and only minor deviations in plasma sodium.

Tissue Content: The increases in sodium and chloride and decreases in potassium in the radiosensitive small intestine indicate that, when metabolic processes are interfered with in acute irradiation injury, the ability to maintain concentration differences between extracellular and intracellular fluids has disappeared. The fact that such changes were restricted to a radiosensitive tissue emphasizes the specificity of acute whole-body irradiation injury. The rapidity of restoration of metabolic processes in damaged tissue is evidenced by the fact that at 96 hours after irradiation the electrolyte pattern in small intestine was normal. At that time such evidences of acute radiation injury, as diarrhea and irritability were at their height.

Although liver samples from the irradiated animals showed an increase in potassium over the pair-fed controls at 24 hours following irradiation, the levels for the pair-fed controls were lower than we have seen in other control animals. We are therefore not certain of the validity of this finding. Since, however, the liver serves as a storehouse of potassium after exogenous and endogenous release (17), it may serve a similar role after tissue losses of potassium following irradiation injury.

Painter (18) found a decrease in intracellular potassium in gut and in skin after an LD 50 of acute whole-body irradiation. There were no changes in intracellular potassium of muscle in her experiments.

CLINICAL IMPLICATIONS

Since rats do not vomit and have a considerable ability to withstand changes in acid-base balance, the results of these experiments do not represent the complete picture of electrolyte changes in cases of the acute radiation syndrome in man. They do indicate, however, directions of change and the general problems that would be encountered.

Acute whole-body irradiation injury at an LD 50 level causes necrosis of radiosensitive tissues which, as in other tissue destruction, is associated with losses of nitrogen and potassium from these tissues.

The severe ulcerative gastroenteritis with oropharyngeal involvement and profuse sanguineous diarrhea which were prevalent in the Japanese casualties suggest that ingestion of food and its subsequent absorption from the gastrointestinal tract would be profoundly depressed. Profuse diarrhea of itself is usually associated with excessive losses of potassium and would add to the deficiency of this important electrolyte. Protracted vomiting is associated with losses of chloride and bicarbonate, and sodium is not only lost in the vomitus but also in the urine if ketosis ensues.

It is obvious that therapy of the acute radiation syndrome must include careful attention to the replacement of potassium and nitrogen as well as other nutrients and that, in view of the severe gastrointestinal changes that occur, parenteral feeding will be indicated. This might be accomplished with a solution of hydrolyzed protein 5 per cent and glucose 5 per cent in isotonic saline with added potassium, thiamin, and vitamin C. If the plasma protein levels are low, two or three units of albumin may be desirable to furnish more rapidly available supplies to the total protein pool of the body.

In considering parenteral therapy, it is important to realize that increased or decreased levels of plasma potassium may be associated with pronounced clinical manifestations, at times sufficient of themselves to cause death. If renal function is impaired, increased amounts of potassium appearing in the blood stream might not be rapidly excreted and, if additional potassium were introduced in parenteral fluids, serious toxic manifestations might ensue. Conversely, if plasma potassium levels are decreased, additional potassium by vein is important. Careful attention to plasma levels of potassium and sodium should be an essential part of the treatment of cases of the acute radiation syndrome in man.

Ideally, the patient suffering from the acute radiation syndrome should be followed as a metabolic problem with daily determinations of electrolyte loss in urine, feces, and vomitus, as well as estimations of the alterations in plasma or serum sodium, potassium, and chloride. It is only by such careful attention to salt and water metabolism that the acute radiation syndrome may be effectively treated.

SUMMARY

Acute whole-body irradiation at an LD 50 level in rats is associated with a loss of potassium and gains in sodium and chloride in a radiosensitive tissue. A radioresponsive tissue and a radioresistant tissue do not show comparable changes. The balance between the intake of potassium, sodium, and chloride in the food and the loss of these elements in the urine and feces is not different in irradiated rats from that in pair-fed control rats. Parenteral feeding and correction of significant alterations in electrolytes are an essential part of the treatment of the acute radiation syndrome.

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SUMARIO

Efectos de la Irradiación X Aguda de Todo el Cuerpo sobre el Metabolismo Salino e Hídrico e Importancia Clínica de los Mismos

La distribución y la excreción de sodio, potasio y cloruro fueron comparadas en ratas sometidas a irradiación X de todo el cuerpo a razón de DL 50 y en testigos alimentados en pares. Además, se observaron las concentraciones de electrolitos en tejido radiosensible, radiorreactivo y radiorresistente.

En el tejido radiosensible se observó pérdida de potasio y aumento de sodio y cloruro. Los tejidos radiorreactivo y radiorresistente no revelaron alteraciones comparables. El equilibrio entre la ingestión de potasio, sodio y cloruro en los alimentos y la pérdida de esos elementos en la orina y las heces no discrepó en las ratas irradiadas de lo observado en los testigos alimentados en pares.

Si bien los resultados de estos experimentos no representan el cuadro completo de las alteraciones electrolíticas en el síndrome irradiatorio agudo en el hombre, sí son indicativos. Unidos a las observaciones clínicas, indican que la alimentación parentérica y la rectificación de las alteraciones importantes en los electrolitos constituyen parte esencial del tratamiento de dicho síndrome.

DISCUSSION

W. Edward Chamberlain, M.D., (Philadelphia, Penna).: It was a real privilege to read Dr. Bowers' paper in advance. As I read it, I became more and more thrilled by this type of work. I can find absolutely no fault with it. I think the conclusions are conservative. The work was well carried out, and I am completely satisfied.

I think it is justifiable to say that from this type of study we are learning what might be done in case of great need in the way of treatment for radiation injuries.

We all realize I am sure, and the authors certainly made it plain, that these changes constitute just one group occurring in connection with radiation exposure. Other injuries will have to be studied and approached from an entirely different point of view.

G. Failla, Sc.D. (New York, N. Y.): You show a considerable loss of potassium from the skeleton. Is it possible to know whether the skeleton includes bone marrow? I would like to know whether the bone marrow was removed from the skeleton before the loss of potassium.

Dr. Bowers: In the first studies that we performed we found a loss of potassium, and we immediately assumed that this was from bone marrow. However, we were intrigued by it and we repeated the experiment. The second time we carefully separated bone marrow and ran parallel analyses. We found that there was a significant loss of potassium from bone.

Question: Have you yet tested the idea that potassium might reverse some changes if given intravenously in irradiated animals?

Dr. Bowers: No. We are hoping that someone else will do that. I should make it clear that we feel that potassium is one part of it; that the important thing is to be very attentive to balance; that, like persons who have had extensive stomach operations or pyloric obstruction, or severe burns, persons who have been exposed to large doses of radiation are going to need potassium in their dietary supplement.

Dr. Kaplan: I am not sure I have the question clear in my own mind yet, whether this potassium has an effect on cells that have been destroyed or disrupted by radiation.

Dr. Bowers: We have considered this problem. In fact, we anticipated that, with the diarrhea, dehydration, shock, and starvation that occur with total-body irradiation injury, we would find losses of potassium from organs and tissues which are not sensitive to radiation.

In this study we therefore took a small intestine in which we found that cells were losing potassium. So we said that this is radiosensitivity. We looked at muscle, and, as you know, in infantile diarrhea and in a variety of conditions associated with shock, such as burns, Darrow and others have found significant losses of potassium from muscle. Our figures at twenty-four hours, ninety-six hours, and nine days after irradiation show no significant changes in muscle. Also, our balance studies were negative.

Finally, on the liver, which as I remarked is quite a pool of potassium, the only increase in potassium occurred at twenty-four hours. All of our subsequent analyses failed to reveal any significant changes in liver electrolytes.

The X-Ray Absorption Coefficients for a Borosilicate Glass[1]

S. L. WHITCHER, PH.D., and NORMAN TODD, B.S.

IN WORK WITH X-rays it is sometimes desirable to be able to calculate the attenuation of the beam during its passage through a glass wall. Such cases arise, for example, in transmission through the envelope of an x-ray tube or during the irradiation of liquids in sealed glass containers. Due to unfavorable geometry exact calculations cannot always be made, but an estimate can be reached when the absorption coefficients of the material are known. Some rather limited experimental data of this kind have been published for soda lime, Ba, and K-Pb glasses (1) but nothing appears to be available for those in the borosilicate group.

The coefficients for one common glass[2] of this type, which has the composition given in Table I (2), are derived here by computation. If similar data are required for other glasses they may be readily obtained by the same method provided the composition is known. The reliability of the results should compare favorably with that of good experimental data.

The coefficients were computed from those of the individual elements by use of the following linear combination formula, first given by Walter (3):

$$\frac{\alpha}{\rho} = \sum_i p_i \left(\frac{\alpha}{\rho}\right)_i \qquad (1)$$

p_i is the weight fraction of the element i in the mixture, ρ_i is its density and α is a dummy symbol which is replaced in the calculations by μ, τ, σ_a, or σ_s. These refer respectively to the total linear absorption coefficient, the linear photoelectric coefficient, the linear true Compton coefficient, and the linear Compton scattering coefficient.

TABLE I: COMPOSITION OF PYREX BRAND CHEMICAL GLASS

Element	Weight Per Cent
Si	37.80
B	4.04
Al	1.16
Na	2.67
K	0.17
O	54.16

A compilation of selected experimental values of the mass absorption coefficients for many elements and for a range of wave lengths has been assembled in the tables of Allen (4). There are of necessity some gaps in these tables since experimental data are lacking for certain elements, notably silicon. Rather than attempt to augment these data, the elementary coefficients were calculated from a formula developed by Victoreen (5) for wave lengths shorter than the K-critical limit. Since all the elements in the glass are of fairly low atomic number, the K-critical limits fall at wave lengths longer than those which are usually of interest.

The formula of Victoreen, which expresses the mass absorption coefficient as a function of Z and λ, may be represented as follows:

$$\frac{\mu}{\rho}(Z, \lambda) = \phi(Z)\frac{Z^3}{A}\cdot\lambda^3 - \psi(Z)\frac{Z^6}{A}\cdot\lambda^4 + \sigma_e N_0 \frac{Z}{A} \qquad (2)$$

where $\phi(Z)$ and $\psi(Z)$ are polynomials in Z and the other symbols have the following significance:

σ_e = Klein-Nishina electron cross section (6),
N_0 = Avagadro number,
Z = Atomic number,

[1] From the Atomic Energy Project, School of Medicine, University of California at Los Angeles. This material originally appeared as Report UCLA-59 and is based on work performed under Contract No. AT-04-1-GEN-12 between the U. S. Atomic Energy Commission and the University of California at Los Angeles. Accepted for publication in June 1952.

[2] PYREX Brand Chemical Glass.

TABLE II: WAVE LENGTH INDEPENDENT PART OF EQUATION 2

Element	Z	$\phi(Z)$*	$\psi(Z)^* \times 10^6$	$\frac{\phi(Z)Z^3}{A}$	$\frac{\psi(Z)Z^6}{A}$	$\frac{Z}{A}$
B	5	0.065	4.70	0.601	0.0068	0.462
O	8	0.099	4.72	3.16	0.077	0.500
Na	11	0.147	4.76	8.51	0.367	0.478
Al	13	0.180	4.78	14.66	0.855	0.482
Si	14	0.197	4.80	19.24	1.288	0.499
K	19	0.283	4.92	49.60	5.920	0.486

* For an explanation of these quantities see reference 5.

TABLE III: COMPARISON OF CALCULATED AND EXPERIMENTAL MASS ABSORPTION COEFFICIENTS

μ/ρ (Mass Absorption Coefficient)

λ, Å.	B		O		Na		Al		Si		K	
	Calculated	Experimental	Calculated	Experimental	Calculated	Experimental	Calculated	Experimental	Calculated	Experimental	Calculated	Experimental
1.235	1.30	1.35	6.0	5.7	15.4	17.1	25.8	26.3	33.4	33.0	79.8	78.0
1.000	0.77	0.76	3.28	3.13	8.3	8.8	14.00	14.12	18.2	17.0	43.9	41.5
0.880	0.58	0.58	2.30	2.20	5.8	6.1	9.46	9.75	12.5	11.8	30.4	29.0
0.710	0.39	0.37	1.48	1.22	3.1	3.3	5.21	5.22	6.8	6.4	16.4	15.4
0.631	0.32	0.31	0.97	0.90	2.6	2.3	3.72	3.73	4.8	—	11.7	—
0.497	0.24	0.22	0.57	0.52	1.20	1.18	1.93	1.90	2.5	—	5.9	—
0.417	0.21	0.20	0.41	0.37	0.78	0.75	1.21	1.17	1.54	—	3.6	—
0.340	0.19	—	0.30	—	0.50	—	0.73	—	0.91	—	2.04	—
0.260	0.17	0.18	0.23	0.21	0.31	0.31	0.42	0.40	0.50	—	1.01	—
0.200	0.15	0.16	0.19	0.18	0.22	0.23	0.27	0.27	0.31	—	0.55	—
0.175	0.14	0.15	0.18	0.17	0.20	0.20	0.23	0.23	0.26	—	0.41	—
0.130	0.13	0.14	0.16	0.16	0.16	0.16	0.18	0.19	0.19	—	0.25	—
0.098	0.12	0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.18	0.19
0.072	0.12	0.13	0.13	0.14	0.12	0.14	0.13	0.14	0.13	—	0.14	—
0.064	0.11	0.13	0.12	0.13	0.12	0.13	0.12	0.13	0.13	—	0.13	—
0.050	0.10	—	0.11	—	0.11	—	0.11	0.12	0.12	—	0.12	—
0.025	0.08	—	0.08	—	0.08	—	0.08	—	0.09	—	0.09	—
λ_K, Å	64.3		23.5		—		7.94		6.73		3.43	

TABLE IV: CONTRIBUTION OF THE INDIVIDUAL ELEMENTS TO THE MASS ABSORPTION COEFFICIENT

λ, A.	B	O	Na	Al	Si	K	μ/ρ	μ
1.235	0.0525	3.250	0.411	0.299	12.625	0.136	16.77	37.74
1.000	0.0311	1.776	0.221	0.162	6.880	0.075	9.15	20.58
0.880	0.0234	1.246	0.155	0.112	4.725	0.052	6.31	14.20
0.710	0.0158	0.802	0.083	0.060	2.570	0.028	3.56	8.01
0.631	0.0129	0.525	0.069	0.043	1.814	0.020	2.48	5.59
0.497	0.0097	0.309	0.032	0.022	0.945	0.010	1.33	2.99
0.417	0.0085	0.222	0.021	0.014	0.582	0.006	0.85	1.92
0.340	0.0075	0.161	0.013	0.0085	0.345	0.0035	0.54	1.21
0.260	0.0069	0.125	0.008	0.0049	0.189	0.002	0.34	0.76
0.200	0.0061	0.103	0.0059	0.0031	0.117	0.0009	0.24	0.53
0.175	0.0057	0.097	0.0053	0.0027	0.098	0.0007	0.21	0.47
0.130	0.0053	0.087	0.0043	0.0021	0.072	0.0004	0.17	0.38
0.098	0.0048	0.076	0.0037	0.0017	0.060	0.0003	0.15	0.33
0.072	0.0048	0.070	0.0032	0.0015	0.049	0.0002	0.13	0.29
0.064	0.0044	0.065	0.0032	0.0014	0.049	0.0002	0.12	0.28
0.050	0.0040	0.060	0.0029	0.0014	0.045	0.0002	0.11	0.25
0.025	0.0032	0.048	0.0022	0.0010	0.033	0.0001	0.09	0.20

A = Atomic weight,
λ = Wave length,
μ/ρ = Mass absorption coefficient.

The first two terms in this expression give the absorption due to the photoelectric effect while the last term represents the total absorption due to incoherent scattering.

The absorption due to coherent scattering, which begins to come in as the wave length approaches atomic dimensions, is

TABLE V: BREAKDOWN OF THE LINEAR COEFFICIENT INTO ITS COMPONENTS

λ, Å.	τ/ρ	σ_a/ρ	σ_s/ρ	$\tau + \sigma_a$	σ_s	μ
1.235	16.57	0.00	0.19	37.29	0.45	37.74
1.000	8.93	0.00	0.19	20.14	0.44	20.58
0.880	6.13	0.01	0.19	13.77	0.43	14.20
0.710	3.36	0.01	0.18	7.59	0.42	8.01
0.631	2.32	0.01	0.18	5.18	0.41	5.59
0.497	1.13	0.01	0.18	2.58	0.41	2.99
0.417	0.67	0.01	0.17	1.53	0.39	1.92
0.340	0.37	0.01	0.16	0.84	0.37	1.21
0.260	0.16	0.01	0.16	0.39	0.37	0.76
0.200	0.08	0.02	0.15	0.21	0.32	0.53
0.175	0.05	0.02	0.14	0.16	0.31	0.47
0.130	0.02	0.02	0.13	0.09	0.29	0.38
0.098	0.01	0.02	0.12	0.07	0.26	0.33
0.072	0.01	0.02	0.10	0.07	0.22	0.29
0.064	0.00	0.03	0.10	0.07	0.21	0.28
0.050	0.00	0.03	0.08	0.07	0.18	0.25
0.025	0.00	0.03	0.06	0.07	0.13	0.20

not included in this formula. But due to the great increase in photoelectric absorption in this region the error in the total coefficient will not be appreciable.

The calculations have been summarized in tabular form. Table II gives values for the quantities in equation (2) which are wave length independent. In Table III appear the calculated values of μ/ρ for the elements in Table I and a comparison with the experimental figures of Allen in so far as they are available. Table IV shows the mass and linear coefficients for the glass in Table I in the quantum energy range 10–500 kev. These were derived by substitution of the figures in Tables I and III into equation (1). Finally, Table V lists a breakdown of the total linear coefficient μ into its components $\tau + \sigma_a$ and σ_s. The latter will be of use when it is desired to neglect or to include only a part of the absorption due to scattering. This choice will be governed by the application to be made of the absorption data.

The authors wish to acknowledge the benefit of correspondence with Mr. R. E. Schneider, of the Corning Glass Works.

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SUMARIO

Los Coeficientes de Absorción de Rayos X para un Vidrio de Borosilicato

Los AA. han computado por derivación los coeficientes de absorción de rayos X por una clase de vidrio de borosilicato, o sea, el Vidrio Químico Marca Pyrex. Los coeficientes se computan por los de los elementos componentes del vidrio, usando una fórmula ofrecida primero por Walter (Fortschr. a. d. Geb. d. Röntgenstrahlen 35: 1308, 1927).

Pueden obtenerse en forma semejante datos para otros vidrios, si se conoce su composición. La exactitud de los resultados debe compararse favorablemente con la basada en buenos datos experimentales.

EDITORIAL

George Winslow Holmes, First Historian of the Radiological Society of North America

The 1952 meeting of the Radiological Society of North America, planned by President Joseph C. Bell, allowed him an opportunity to fulfill a long contemplated desire, the addition to the program of an historical lecture. His belief that such a reminder to the members, of the tremendous influence the builders have had on the present structure of the science of radiology, indicates his perspicacity. He chose as the subject a renowned physiologist, an important contributor to our specialty, namely, Walter Bradford Cannon. The first historian was found in George Winslow Holmes, a noted teacher of radiology. Association of lecturer and subject is not unusual, but in fact Dr. Cannon and Dr. Holmes were long associated as teachers, as friends, and finally as respective patient and physician.

George W. Holmes, Chief of the Department of Radiology at the Massachusetts General Hospital from 1916 to 1941, and later during World War II, has continued his activities not only as a physician but as a teacher since his "retirement." In the Waldo County Hospital, Belfast, Maine, he is the radiological consultant, and his influence has been strong on his fellow staff members and on the community.

To reiterate his many accomplishments and to name his many stellar students would be sheer repetition. It is a pleasure, however, to recall some of the things that make him the outstanding teacher his students have known and loved.

A basic attribute of an educator is his willingness to meet a challenge. Dr. Holmes was asked to deliver a lecture, the first of its kind, before a society of which he was not a member, and this constituted a real challenge. That he met it admirably, and even relished doing so, is evident from his presentation, which is to be found elsewhere in this issue of RADIOLOGY. His consummation of this invitation brings to mind a favorite New England story about a "down Mainer" who entered a barber shop the morning after a heavy alcoholic bout. His "shakes" were so uncontrolled that they became contagious until, between the shaking customer and the shaking barber, the former received extensive cuts. Eventually, profuse bleeding having been checked, the customer went on his way. A few days later he returned and climbed into the chair. The barber approached with the query "Want a shave?" to which the customer replied "Nope, just came back to show you I ain't afraid of you."

Dr. Holmes's love of a good story and his keen sense of humor are well known. His yarns are famous; probably those he enjoys most are the ones that are typical of dry Yankee wit. Like everyone whose sense of humor is genuine, he is able to laugh kindly and at his own expense.

Far more important even than his humor and his eager acceptance of a challenge is his extreme honesty. Intellectual integrity in an educator is a vital requirement, unsurpassed by any other inherent quality. Close on its heels follow common sense and logical reasoning. That these traits be fostered in the student depends on the teacher having set the example. There was never an instance when a resident, in training under Dr. Holmes, was criticized for making an incorrect diagnosis—provided he had reasoned correctly. If, how-

ever, he had reasoned illogically, his mistakes were noted in a calm, precise manner. More than once after one had arrived by luck rather than reason at a correct diagnosis, Dr. Holmes' dry comment would be "You're right, but you're wrong."

Modesty is another inestimable characteristic. Dr. Holmes took no undeserved credit. One of his most typical remarks in this vein was made at a dinner given in his honor by his former students when the Radiological Society of North America met in Boston. Dr. Holmes pointed out that he had not been fortunate enough to have sons of his own and that whatever he may have accomplished in the field of radiology was due to "his boys."

Provocation of free thought is one of his methods of teaching. Many have been the sessions where this stimulating method was practised. Discussion was free and open, sometimes to the point of extreme heatedness, and afforded a delightful approach to the teaching of young men. Often a statement made at such a session provoked an idea which was carried to a future valuable practicality. Dr. Holmes enjoyed frank expression of opinion and encouraged everyone to speak his mind with complete freedom and bluntness.

These are a few of the traits which have made Dr. Holmes a remarkable teacher and have enabled him to present so adequately the first historical lecture before the Radiological Society of North America. It is anticipated that his will be one of a long series of lectures concerning the historical aspects of radiology. A forward step has been taken by an enterprising president which has whetted the appetites of the members for more. As an old New Hampshire farmer said to a stranger who tried to start conversation one beautiful, crystal-clear autumn morning with the remark that the day was a lovely one, "Hmm, it's begun good," so the members of the Radiological Society say to Dr. Bell's innovation on the annual program, it certainly has "begun good."

LAURENCE L. ROBBINS, M.D.

ANNOUNCEMENTS AND BOOK REVIEWS

ATLANTA RADIOLOGICAL SOCIETY

At a recent meeting of the Atlanta (Georgia) Radiological Society, the following officers were elected: Dr. Calvin B. Stewart, President; Dr. Ted Leigh, Vice-President; Dr. Albert A. Rayle, Jr., 490 Peachtree St., N.E., Atlanta, Secretary.

BALTIMORE CITY MEDICAL SOCIETY RADIOLOGIC SECTION

Dr. David N. Gould was recently elected Chairman of the Radiologic Section of the Baltimore City Medical Society. Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17, continues as Secretary.

CHICAGO ROENTGEN SOCIETY

The newly elected officers of the Chicago Roentgen Society are: President, Roger A. Harvey, M.D.; Vice-President, Erich Uhlmann, M.D.; Secretary-Treasurer, Elbert K. Lewis, M.D., 6337 South Harvard Ave., Chicago 21.

SECTION ON RADIOLOGY, MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA

The Section on Radiology of the Medical Society of the District of Columbia, at its recent meeting, elected the following officers for the ensuing year: President, Dr. Alfred A. J. Den; Vice-President, Dr. David H. Rosenfeld; Secretary, Dr. Alvin C. Wyman, 5445 28th St. N.W., Washington.

LOS ANGELES RADIOLOGICAL SOCIETY

At the May meeting of the Los Angeles Radiological Society, the following officers were elected for the year 1953–54; President, Joseph F. Linsman, M.D.; Vice-President, M. M. Haskell, M.D.; Treasurer, Hubert J. Prichard, M.D.; Secretary, George Jacobson, M.D., 1200 North State St., Los Angeles 33. Dr. Harold P. Tompkins and Dr. John Hamilton were elected to the Executive Committee.

MARYLAND RADIOLOGICAL SOCIETY

At the initial meeting of the Maryland Radiological Society, Dr. Richard B. Hanchett of Baltimore was elected Chairman; Dr. E. T. Campbell of Hagerstown, Vice-Chairman; Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17, Secretary.

NEW ENGLAND ROENTGEN RAY SOCIETY

At the Annual Meeting of the New England Roentgen Ray Society, held at the Hotel Somerset, Boston, on May 15, the following officers were elected for the ensuing year: President, Dr. Laurence L. Robbins; Vice-President, Dr. Alice Ettinger; Treasurer, Dr. Magnus I. Smedal; Secretary, Dr. Stanley M. Wyman, Massachusetts General Hospital, Boston 14.

Dr. Edith H. Quimby of New York delivered the annual Holmes Lecture. Her subject was "Diagnostic Uses of Radioactive Isotopes."

RADIOLOGICAL SOCIETY OF NEW JERSEY

The Radiological Society of New Jersey held its Annual Meeting in May, electing the following to serve as its officers for the year 1953–54: Dr. Vincent M. Whelan of Red Bank, President; Dr. Nicholas G. Demy of Plainfield, Vice-President; Dr. C.-B. Henle of Newark, Treasurer; Dr. Salomon Silvera, 921 Bergen Ave., Jersey City, Secretary.

PHILADELPHIA ROENTGEN RAY SOCIETY

At the May meeting of the Philadelphia Roentgen Ray Society, the following were elected to office for the 1953–54 term: George P. Keefer, M.D., President; Rolfe Harvey, M.D., Vice-President; Herbert M. Stauffer, M.D., Temple University Hospital, Philadelphia 40, Secretary; D. Alan Sampson, M.D., Treasurer; Richard H. Chamberlain, M.D., Counsellor.

RADIOLOGICAL SOCIETY OF HAWAII

At a meeting on June 19, the following officers of the Radiological Society of Hawaii were elected for the ensuing year: President, Dr. Tetsui Watanabe; Vice-President, Dr. Peter Washko; and Secretary-Treasurer, Dr. Philip S. Arthur, Suite 42, Young Hotel Bldg., Honolulu 13. Dr. Louis L. Buzaid continues as Councilor.

Meetings are held on the third Friday of each month at a place designated by the Secretary.

FIFTH ANNUAL CANCER SEMINAR PENROSE CANCER HOSPITAL

The Fifth Annual Cancer Seminar sponsored by the Penrose Cancer Hospital of Colorado Springs, Colo., and the American College of Pathologists, will be held at the Broadmoor Hotel, Colorado Springs, on Sept. 5, 1953.

The subject of this year's Seminar will be Lesions of the Small Bowel. The guest radiologist will be Dr. Paul C. Swenson, Professor of Radiology at Jefferson Medical College; the guest pathologist Dr. William A. Meissner of the Deaconess Hospital of Boston. Dr. Harry M. Weber of the Mayo Foundation, Rochester, Minn., will be the guest of honor.

RADIOLOGICAL HEALTH PROGRAM

A series of short courses in radiological health is again being presented by the Public Health Service

at the Environmental Health Center in Cincinnati, Ohio. These courses, tuition free, are designed primarily to provide professional personnel working in health departments and other organizations with a working knowledge of the health hazards associated with radiation. Candidates should have a degree in medicine, engineering, or science (physical or biological).

Basic Courses, which stress basic radiation physics and survey technics, will be presented Oct. 5–16, 1953, Jan. 11–22, 1954, and May 3–14, 1954. Intermediate Courses, with emphasis on radioelements and x-ray survey technics, are scheduled for Oct. 19–30, 1953, Jan. 25–Feb. 5, 1954, and May 17–28, 1954. An Advanced Course will be given Feb. 8–19, 1954, for professional personnel concerned in particular with occupational health problems.

The Basic Course or its equivalent is a prerequisite for the Intermediate Course, and the Intermediate Course or its equivalent for the Advanced Course.

Further details and information may be obtained by writing: Chief, Radiological Health Training Section, Public Health Service, Environmental Health Center, Cincinnati, Ohio.

AMERICAN CANCER SOCIETY FELLOWSHIPS IN RADIATION THERAPY

The American Cancer Society has recently inaugurated a program for training clinical fellows in radiation therapy. These fellowships are offered to properly qualified graduates in medicine who have already received thorough basic training in the principles and practice of radiation therapy, and who desire to spend additional periods of training in that specialty at certain clinics in the United Kingdom, the Scandinavian countries, and France.

Fellowships are available to (1) citizens of the United States, (2) who are graduates of recognized medical schools in the United States, (3) who have previously received training in therapeutic radiology acceptable to the American Board of Radiology as credit toward certification, and (4) who are under forty years of age. In the selection of applicants, priority will be given to physicians (1) who are already certified by the American Board of Radiology, (2) who have completed the required training in preparation for Board examinations but have not yet taken the examinations, and (3) those who, while intending to complete Board requirements and take the examinations, are still in the training period.

The annual stipend for fellows in radiation therapy is $4,500 per year, including travel. The fellowship period is one year, although in exceptional circumstances, and when not competing with new applications, renewal for a year or less will be considered.

All arrangements for affiliation with foreign institutions in which the fellowship year is to be passed must be made by the applicant or his preceptor directly with the appropriate officials in those institutions, and the American Cancer Society will assume no responsibility therefor. Acceptance of fellows for training in foreign institutions must precede submission of applications to the American Cancer Society.

Fellows shall render to the American Cancer Society such reports of progress or accomplishments as shall be requested.

For further information address Brewster S. Miller, M.D., Director, Professional Education Section, American Cancer Society, 47 Beaver St., New York 4, N. Y.

OAK RIDGE ISOTOPES COURSE

The Special Training Division of the Oak Ridge Institute of Nuclear Studies has scheduled an advanced course, covering the clinical applications of radioisotopes, to be held from Sept. 14–25, 1953. Participation will be limited essentially to those physicians who have had clinical experience with radioisotopes.

Additional information and application blanks may be obtained from the Special Training Division of the Institute, P. O. Box 117, Oak Ridge, Tenn.

BERTNER FOUNDATION AWARD

At the Seventh Annual Symposium on Fundamental Cancer Research, held May 15 and 16, in Houston, Texas, the Bertner Foundation Award, conferred annually upon a physician or scientist in recognition of an outstanding contribution to some field of cancer research, was presented to Dr. Charles B. Huggins, Professor of Surgery, University of Chicago School of Medicine, for his classic studies in the control of human cancer by physiologic methods. Dr. Huggins also delivered the annual Bertner Lecture.

Letters to the Editor

CLINICAL EXPERIENCE WITH IRRADIATION THROUGH A GRID

To the Editor of Radiology

DEAR DOCTOR DOUB:

In RADIOLOGY **58:** 338–342, March 1952, there was published a paper entitled "Clinical Experience with Irradiation Through a Grid" by Dr. Hirsch Marks. The paper was first presented at the 36th Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 10–15, 1950. I had the privilege of discussing the original paper, together with those by Dr. William Harris, and Dr. Robert Loevinger and Mr. Wilbert Minowitz, on the same subject. I have in my files a copy of this original paper sent to me by Dr. Marks for the

purposes of discussion. He originally reported 100 cases treated with the grid. In the interim between presentation of the paper and its final publication 100 further cases were added.

In the published paper, Dr. Marks gives the impression that he used a lead-rubber grid between 1943 and 1951. He refers in one paragraph (p. 340) to a case treated in 1944, and in the following paragraph refers to one case treated in 1948. No mention is made of cases treated in the intervening years.

In the *Journal of the American Medical Woman's Association* **5:** 129–135, April 1950, Dr. Anna Goldfeder describes a grid, made of lead rubber, which appears to overcome the objection of the previously used grids made of lead.

In RADIOLOGY **57:** 845–860, December 1951, in an article originally presented at the 36th Annual Meeting of the Radiological Society of North America in Chicago (Dec. 10–15, 1950), Dr. Anna Goldfeder refers to Grynkraut's work with a lead grid covered with aluminum foil. She states that she persuaded the radiation therapist at the Cancer Hospital, New York City (Dr. H. Marks), to apply the method of using large doses through a grid and moreover suggested the use of lead rubber. She mentioned to me personally that Dr. Marks had not used the lead-rubber grid prior to 1947. During my early association with Bellevue Hospital, New York (1946), I had the opportunity to attend Dr. Goldfeder's lectures, at which time she demonstrated the possibility of applying large doses of radiation to animal tumors by the use of small areas while the normal tissue was shielded. She advocated that a similar method be applied in clinical radiation therapy when larger doses are required.

B. Grynkraut, in a paper entitled "Direct and Indirect Radiotherapy," published in the *American Journal of Roentgenology and Radium Therapy* in May 1945 (**53:** 491–499, May 1945) referred to two of Dr. Anna Goldfeder's early papers (Warszawskie czasop. lek., 1939, and Am. J. Cancer **36:** 603–608, 1939). In these papers, Dr. Goldfeder mentioned the large doses applied to malignant tissues *in vitro* (25,000 r) in order to render the tissue culture sterile. In a later paper (Further Studies on the Relation Between Radiation Effects, Cell Viability, and Induced Resistance to Malignant Growth. VI. Anomalous Radiosensitivities of Analogous Mouse Mammary Adenocarcinomas. Radiology **54:** 93–115, January 1950), Dr. Goldfeder showed that mice receiving up to 24,000 r to a tumor not only survived these massive doses, but were also cured of the tumor.

In Dr. Marks' original paper, submitted to me for discussion, no mention was made of Dr. Goldfeder's work. In the final published paper, Dr. Marks does refer to these contributions. However, the significance of the observations is minimized, apparently because of a lack of understanding of several important points. The first is the power to recover, of a small area subjected to a large dose of irradiation, as noted in the above animal experiments. The second point arises out of a failure to interpret correctly the physics of the grid, as evidenced in Dr. Marks' statement: "The optimum dose without a grid enters the tumor-bearing area, while in the grid method only 40 per cent of the 24,000 r in air, or 9,600 r in air, enters the tumor-bearing area to produce a lytic effect."

Loevinger and Minowitz (J. Mt. Sinai Hosp. **17:** 49, May–June 1950) have pointed out that the depth dose through the open area of a treatment grid, using a 10 × 15-cm. field, actually amounts to the sum of the dose due to the primary beam and 40 per cent of the scattered radiation.

These observations suggested to me that Dr. Marks started his work of using massive doses of x-ray with the lead-rubber grid in 1947 or 1948.

I have presented these facts and observations only in the interest of recording the early history of the use of the lead-rubber grid in x-ray therapy. I believe that we owe to Dr. Anna Goldfeder an acknowledgment of her work, in animals, using large doses of irradiation through small portals, and her subsequent original suggestions for the use of the lead-rubber grid in clinical therapy.

Yours sincerely,

WILLIAM L. PALAZZO, M.D.
Teaneck, N. J.

To the Editor of Radiology

DEAR DOCTOR DOUB:

It is a matter of record in the Clinic of the Cancer Institute of the City of New York that two grids, one reciprocal to the other, were made to my specifications in 1942 by the resident therapist, Dr. Alexander Lewitan, using lead-rubber 3 mm. in thickness. The writer was acquainted with the principles of grid therapy since its introduction in this country by Dr. Liberson in 1933. He was stimulated by Liberson's revival of the grid but found its use wanting in the following respects: (1) oversight of a physical factor in fashioning the grid out of pure lead, which contributed enormous quantities of secondary rays from the lead, thus lowering instead of increasing the tolerance of the skin; (2) disproportionate ratio of opaque to open areas in the grid, which resulted in either inadequate coverage with, or inadequate protection from, radiation; (3) alternate method of application, as the total tolerable dose per single field fell far short of a cancerocidal dose, and (4) mode of application, that is, in massive doses.

The writer therefore (1) replaced pure lead with lead rubber of increasing thickness (3, 4, and 8 mm.), dictated by physical considerations, *i.e.*, transmission of x-rays through the covered zones of the lesser thicknesses, which is completely eliminated with the 8-mm. grid; (2) selected a fixed ratio, empirically determined, of 40 per cent open to 60 per cent

closed of the square surface area in any sized grid used, which contributes to the recovery of the optimally irradiated areas, (3) adopted the non-alternating method whereby the grid is placed in the same position at each treatment, thus safeguarding islands of relatively unscathed skin in which healing is initiated and extends to the irradiated zones; (4) applied the grid with fractionated x-ray doses in accordance with the general and local needs of the patient, *i.e.*, clinically (Coutard method).

The clinical method of x-ray therapy assigns to the normal tissue surrounding the malignant growth an important role in the reduction of cancer by irradiation. Coutard's name became synonymous with this method because he was the first to establish empirically the lowest fractionated dose compatible with the normal tissues yet efficacious in advancing its ramparts against the encroaching disease. This dose must be relatively innocuous to the normal tissue but increasingly destructive in its cumulative effect in time upon the malignant growth.

Thus, it has become axiomatic that the normal tissue must remain inviolate while the tumor is irradiated, *i.e.*, it must tolerate with impunity the quanta of radiating energy deleterious to the cancer. In this connection, it should be mentioned that norma tissue, as reported in 1931 by Lecomte de Nouy in an account of his experiments on irradiation of the same in culture, has a high margin of safety. A dose of 25,000 roentgens effected only a decrease in the proliferation of normal tissue irradiated *in vitro*, while the lethal dose was 120,000 roentgens. It is this belief in the validity of the contribution of de Nouy, later repeated by Goldfeder *in vivo*, which prompted the writer to refer to this work.

I developed the new grid technic empirically by gauging the dose which would have a lethal effect on the tumor but be innocuous to normal tissue. The criteria for reaching optimum doses were the volume, depth, and sensitivity of the tumor. There was greater skin tolerance when grids were used having portals of the following dimensions: 2.0, 1.5, 1.0, and 0.5 cm. These dimensions were dictated by physical measurements on small portals by Mayneord in 1938, and by radiobiological investigations of Jolles in 1941.

The apertures in the grid comprise 40 per cent of the total square surface area of any sized grid used. Since the depth dose, all things being equal, is a function of the volume of tissue irradiated, the average energy distribution through a grid will thus closely correspond to and may be easily computed on this basis (40 per cent) from standard depth-dose charts. Thus, in x-ray therapy through a grid 8 mm. in thickness, with an area ratio of 40 per cent open to 60 per cent closed, only 40 per cent of the air dose will impinge upon the skin and a mere fraction of this skin dose will enter the tumor-bearing area, since 60 per cent of the energy source is not transmitted, or in other words is wasted. This low efficiency of the grid is what has prompted Koehler and the writer to increase the dose. The failure to realize this was one of the main reasons for the twilight of the grid in the past few decades.

The writer has treated more than 200 patients from 1943 continuously till the present, but only 102 of these were tabulated on page 340 of RADIOLOGY, Vol. **58,** March 1952, because of lack of adequate follow-up. We continued our treatments without interruptions and reported only those who survived and on whom a complete follow-up was available.

Yours sincerely,
HIRSCH MARKS, M.D.
New York City

APPLICATION OF TELEVISION ELECTRONICS TO FLUOROSCOPIC IMAGE INTENSIFICATION

To the Editor of Radiology

DEAR DR. DOUB:

In his Carman Lecture, published in the March 1953 issue of RADIOLOGY, Dr. Richard H. Chamberlain touched briefly on some of the early developments in the application of television electronics to the problem of fluoroscopic image intensification. Since television electronics are likely to play an increasingly important role in fluoroscopy in the future, I thought that it might be well to amplify Dr. Chamberlain's remarks.

I do not know when the idea of employing television principles in x-ray fluoroscopy first was conceived. Dr. Paul C. Hodges and I have correspondence in our files dating back to 1939 which indicates that the idea was not new at that time. Probably the first thinking on the subject developed soon after A. A. Campbell Swinton, in a letter to *Nature* in June, 1908, outlined for the first time an electronic television system embodying most of the basic ideas which are used in television engineering today.

In the early 1940's, successful x-ray fluoroscopy with television equipment was not possible because of the insensitiveness of the television detecting equipment which was available at that time. It was hoped that, with the development of the image orthicon late in World War II, a sufficiently sensitive television instrument might be at hand. However, tests which Dr. Hilleboe and I made early in 1946 at the Radio Corporation of America in Lancaster, Pennsylvania, again were unsuccessful except when x-ray beams of high intensity were employed.

As far as I can determine, the first successful marriage-in-fact of television and x-ray fluoroscopy occurred in 1948, when Dr. Roy K. Marshall, in a network television broadcast, demonstrated the roentgen appearance of several extremities. For this broadcast, Dr. Marshall used a General Electric portable machine operating at 10 milliamperes, con-

ventional roentgenographic kilovoltage, and conventional fluoroscopic distance. As a member of the television audience at that time, I recall that the amplified fluoroscopic images appearing on my television screen were quite good. About a year later, Ralph Sturm and I were able to duplicate Dr. Marshall's experiment on another television broadcast as part of one of the programs of "The Johns Hopkins Science Review." It should be pointed out here, however, that even at that time, the image quality of the television system was not sufficiently good for clinical use, even on an experimental basis.

Early in 1949, the Radio Corporation of America, after considerable work, developed a new type of image orthicon, which was considerably more sensitive than those previously available. Late in that year, Dr. Chamberlain used this tube for the first time, I believe, in x-ray fluoroscopy and demonstrated its merit.

We shall always be deeply grateful to Dr. Chamberlain for the experimental work which he performed late in 1949, for it was from this that we were stimulated to embark upon an extensive research program in the field of electronics as applied to x-ray fluoroscopy.

Yours sincerely,

May 18, 1953 RUSSELL H. MORGAN, M.D.
Radiologist-in-Chief
Johns Hopkins Hospital

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

TUMORS OF BONE. A ROENTGENOGRAPHIC ATLAS. Annals of Roentgenology, Vol. XXI. By BRADLEY L. COLEY, M.D., F.A.C.S., Attending Surgeon, Bone Service, Memorial Center for Cancer and Allied Diseases; Associate Professor of Clinical Surgery, Cornell University Medical College, New York, and NORMAN L. HIGINBOTHAM, M.D., C.M., F.A.C.S., Associate Attending Surgeon, Bone Service, Memorial Center for Cancer and Allied Diseases; Assistant Professor of Clinical Surgery, Cornell University Medical College, New York. A volume of 216 pages, with 172 figures. Published by Paul B. Hoeber, Inc., New York, 1953. Price $10.00

THE PLURIPOTENCY OF THE HYPOPHYSEAL HORMONES AND THE CONSEQUENCES FOR ENDOCRINOLOGY AND CANCEROLOGY. By DR. JULES SAMUELS, Specialist for Endogenous Endocrinotherapy, Director of the Central Institution for the Samuels-Therapy, Amsterdam. A volume of 296 pages. Published by N. V. Cycloscoop, Amsterdam, 1953. Price f 37.00.

THE CONCEPTION OF DISEASE, ITS HISTORY, ITS VERSIONS AND ITS NATURE. By WALTHER RIESE, M.D. A volume of 120 pages. Published by the Philosophical Library, New York, 1953. Price $3.75.

RADIOLOGIE DU REIN ET DE L'URETÈRE. By R. GOUVERNEUR, Chirurgien de l'Hôpital Necker, Chef du service d'Urologie, P. PORCHER, Radiologiste de l'Hôpital Saint-Antoine, and R. HICKEL, Radiologiste des Hôpitaux, Radiologiste du service d'Urologie de l'Hôpital Necker. A volume of 440 pages, with 412 figures. Published by Masson & Cie, Paris, 1953. Price 5.400 fr.

Book Reviews

THE 1952 YEAR BOOK OF RADIOLOGY (JUNE, 1951–JUNE, 1952). RADIOLOGIC DIAGNOSIS, edited by FRED JENNER HODGES, M.D., Professor and Chairman, Department of Roentgenology, University of Michigan, and JOHN FLOYD HOLT, M.D., Associate Professor, Department of Roentgenology, University of Michigan. RADIATION THERAPY, edited by HAROLD W. JACOX, M.D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York City, and VINCENT P. COLLINS, M.D., Professor and Chairman, Department of Radiology, Baylor University, College of Medicine; Radiologist-in-Chief, Jefferson Davis Hospital, Houston, Texas. A volume of 416 pages, with 387 illustrations. Published by the Year Book Publishers, Chicago, Ill., 1952. Price $7.50.

The 1952 Year Book of Radiology continues to offer within the scope of a single volume of handy proportions the most significant contributions to radiologic diagnosis and radiotherapy for the year covered, in this instance June, 1951–June, 1952.

With the multiplication of medical journals and the expanding scope of radiology, the choice of papers to be presented and their correlation is no mean task. As the editors of the Section on Therapy point out: "Progress, as reflected in the literature, inches forward in a manner that is continually surprising. Some subjects of early conjecture gradually clarify and resolve themselves into every-day usage . . . . Listless reporting of some subjects flares into hot debate to bring long accepted concepts into critical review . . . . Other endeavor, that has struggled with seemingly monumental handicaps, gathers momentum and moves strongly to new appreciation." Such progress, unnoticed from month to month, becomes evident when the contributions of a year are assembled.

Little further need be said in review of a volume that has become standard. The names of its editors guarantee its excellence.

DIZIONARIO TECNICO DI RADIOLOGIA, ITALIANO—FRANCAIS—DEUTSCH—ENGLISH—ESPAÑOL. By FRANCO FOSSATI, Membro del Comitato Tecnico della Societá Italiana di Radiologia Medica. A volume of 490 pages. Published by A. Wassermann, Milan, Italy, 1952.

Everyone dealing with the world literature on radiology has been faced with the difficulty of transferring from one language to another the exact meaning of certain terms, more especially those of technical significance. Even an accomplished linguist may find himself at a loss for a technically good translation and too frequently satisfies himself with a transliteration that serves only to confuse the reader.

A brave attempt has been made to solve this problem by Franco Fossati, whose "Technical Dictionary of Radiology" is issued under the auspices of the Societá Italiano di Radiologia Medica. Actually this is a book of synonyms rather than a dictionary in the commonly accepted sense. The first part lists the Italian words, followed by the equivalent terms in French, German, English, and Spanish. Thus:

cono di radiazioni
cone de centrage
Strahlungskegel
radiation cone
cono de radiociones.

This is followed by four separate dictionaries: French-Italian, German-Italian, English-Italian, and Spanish-Italian. In these the "foreign" term is followed immediately by the corresponding Italian word, as *"half-value layer: strato emivalente."*

Exact equivalence of terms is not always possible, and this work may leave something to be desired. Nevertheless, it will be of real use to those with a limited knowledge of languages who are interested in following the foreign radiological literature, and more especially to editorial workers and translators in this specialty.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Robert E. Fricke, M.D., Mayo Clinic, Rochester, Minn.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 15 East Monroe, Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Calvin L. Stewart, M.D., 2330 First Ave., San Diego.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, George Jacobson, M.D., 1200 North State St., Los Angeles 33. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL SOCIETY. *Secretary*, Richard C. Ripple, M.D., 1215 28th St., Sacramento. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, C. W. Bruner, M.D., 2456 Fourth Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, William H. Graham, M.D., 634 E. Santa Clara St., San Jose 12. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm. W. Saunders, M.D., VA Hospital, San Francisco 21. Meets third Thursday at 7:45, Lane Hall, Stanford University Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Wm. S. Curtis, M.D., Boulder Medical Center, Boulder. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Alvin C. Wyman, M.D., 5445 28th St., N.W., Washington. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. Judson Graves, M.D., 2002 Park St., Jacksonville. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, E. Hampton Bryson, M.D., 273 Alhambra Circle, Coral Gables. Meets monthly, third Wednesday, 8:00 P.M., Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 490 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D , 218 Doctors Bldg., Atlanta. Meets in Novemb er and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Col. Alexander O. Haff, Tripler Army Hospital, Honolulu. Meets monthly on the third Friday, at Tripler Army Hospital.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 23 East Ohio St., Indianapolis. Annual meeting in May.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary*, James T. McMillan, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and holds a scientific session in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Willis L. Beller, M.D., 700 Kansas Ave., Topeka. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Hugh Allan Smith, M.D., Eastern Maine General Hospital, Bangor. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

MARYLAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, John R. Hodgson, M.D., The Mayo Clinic, Rochester. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 117 N. President St., Jackson, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Sidney Rubin, M.D., 410 Professional Bldg., Kansas City, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Francis O. Trotter, Jr., M.D., 634 North Grand Blvd., St. Louis 3. Meets on fourth Wednesday, October to May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary*, Grant P. Raitt, M.D., 413 Medical Arts Bldg., Billings. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James F. Kelly, Jr., M.D., 816 Medical Arts Bldg., Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Salomon Silvera, M.D., 921 Bergen Ave., Jersey City. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, and October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 8:45 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Joseph J. La Vine, M.D., 259 North Grand Avenue, Baldwin, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Harold W. Jacox, M.D., 622 W. 168th St., New York 32.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John F. Roach, M.D., Albany Hospital, Albany. Meets in the capital area second Wednesday, October, November, March, and April. Annual meeting in May or June.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, A. Gordon Ide, M.D., 277 Alexander St. Meets at Strong Memorial Hospital, 8:15 P.M., last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Clifford C. Baker, M.D., Harwood Bldg., Scarsdale. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, M.D., 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Willis S. Peck, M.D., 1838 Parkwood Ave., Toledo 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Chapin Hawley, M.D., 927 Carew Tower, Cincinnati 2. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, W. S. Koller, M.D., 60 Wyoming St., Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Herbert M. Stauffer, M.D., Temple University Hospital, Philadelphia 40. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., West Penn Hospital, Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., 1037 Stuart Bldg., Lincoln, Nebr.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. William A. Klauber, M.D., Self Memorial Hospital, Greenwood. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Donald J. Peik. M.D., 303 S. Minnesota Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, Harvey Thompson, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., Newell Hospital, Chattanooga 2. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, Claude Williams, M.D., Fort Worth. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Harry Fishbein, M.D., 324 Medical Arts Bldg., Houston 2.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 29–30, 1954, Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., 1308 Manteo St., Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John N. Burkey, M.D., 555 Medical-Dental Bldg., Seattle. Meets fourth Monday, September through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Rafael A. Blanes, M.D., Box 9724 Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, D. L. McRae, M.D. Assoc. Hon. Secretary-Treasurer, Guillaume Gill, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday of each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosio, Marsella 11, Mexico, D.F. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Breast

The Digestive System

The Musculoskeletal System

The Spinal Cord

Gynecology and Obstetrics

Genito-Urinary System

The Blood Vessels

Technic; Contrast Media

ROENTGEN AND RADIUM THERAPY

RADIOISOTOPES

RADIATION EFFECTS

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Slow Technique for Cerebral Angiography. W. A. Shafer. West Virginia M. J. **48:** 226–228, August 1952.

The author describes a technic of angiography which obviates complicated mechanisms and provides adequate visualization of both the arterial and venous cerebral circulation.

The procedure is done on a conventional table, under light Pentothal or local anesthesia, following premedication with papaverine and atropine. Exposure factors are 100 ma. at two seconds, a target distance of 36 inches, and 56 kv. with a Lysholm grid for the lateral view and 70 kv. for the anteroposterior view. If a phlebogram is desired, the kilovoltage is reduced and the time increased accordingly.

The technic of percutaneous puncture of the carotid artery is described in detail. Fifteen cubic centimeters of the contrast medium is injected as fast as the plunger of the syringe can be depressed. Exposure is begun when about one-third of the medium has been injected, resulting in the completion of the injection and the exposure at approximately the same moment.

If Diodrast is used, a skin test is made; if this proves positive, Thorotrast is substituted. The percentages of the media used are not given. No deaths or distressing reactions occurred in 20 cases.

The angiograms accompanying the article are difficult to evaluate because of the usual loss of quality in reproduction.

PAUL R. NOBLE, M.D.
Pittsburgh, Penna.

Clinical Experience with Urokon Sodium 30 per cent (pH7) for Cerebral Arteriography. William B. Seaman and Henry G. Schwartz. J. Missouri M. A. **49:** 553–554, July 1952.

In eight months the authors performed 40 angiographic studies on 36 patients, with a total of 142 intracarotid injections of 30 per cent Urokon buffered to a pH of 7.0. They averaged 3.5 injections per patient and 9.3 c.c. of medium per injection.

The immediate reactions were definitely less than with other contrast media. Minor reactions occurred in 7 patients, or 17.5 per cent. These were mainly transient facial flush, rise in blood pressure, transient confusion, and facial paralysis or mild hemiparesis of very brief duration.

Major complications occurred in 3 cases, which are reported in detail, though a causal relationship to administration of Urokon was doubtful. One patient died, having had hemorrhage in a glioma of the medulla and pons after a second series of injections. In the other 2 hemiplegia developed; both had histories of previous hemiparesis, hypertension, and arteriosclerosis.

The authors believe the medium is relatively safe and that further investigation of it is warranted.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Transient Loss of Vision Following Cerebral Arteriography. Frank J. Otenasek and James Markham. J. Neurosurg. **9:** 547–551, September 1952.

A case of transient visual failure following cerebral arteriography is presented. This case was characterized by unilateral central scotoma on the injected side, with constriction of peripheral fields occurring within two hours after injection of 35 per cent Diodrast and complete recovery within forty-eight hours. The mechanism responsible for this unusual reaction is not entirely clear. Embolism or thrombosis of the central retinal artery or vein or of a retinal vessel can be excluded on the basis of the funduscopic examination and the complete recovery. That spasm may have contributed cannot be excluded. Sensitivity to Diodrast as a factor was apparently ruled out by a negative conjunctival test. A therapeutic stellate ganglion block with 1 per cent procaine, performed six hours after the arteriographic study, may have been beneficial in this case.

When impairment of vision occurs following cerebral arteriography and there is no ophthalmologic evidence of vascular alteration, the prognosis for restoration of vision is probably favorable.

Bone Changes in Cases of Suprasellar Meningioma. Giovanni Di Chiro and Erik Lindgren. Acta radiol. **38:** 133–138, August 1952.

Meningiomas may manifest their presence on plain films by new bone formation, bone destruction, increased vascular channel markings on the calvarium and, in some cases, osteosclerosis at the point of origin. It would appear from the literature, however, that suprasellar meningiomas rarely cause bone changes, but this, the authors believe, is due to lack of appreciation of the small changes present. These consist in variations in the thickness of the planum sphenoidale and in the size and shape of the limbus sphenoidalis, the tuberculum sellae, and the sulcus of the optic chiasm between them. The more frequent variations are illustrated by line drawings.

In a review of 45 verified cases of meningioma, the immediate presellar area was normal in 22 cases; in 23 cases there was thickening of the planum sphenoidale immediately in front of the limbus sphenoidalis. This thickening usually measured 4 to 6 mm., but in some cases was almost 1 cm. The bone structure in the region of the change was pathologically altered, being more or less irregular, with the surface not evenly or sharply defined as in the normal skull.

The bone changes of suprasellar meningiomas are most clearly visualized in a perfectly lateral view taken with beam projection parallel to the planum sphenoidale. Tomography may occasionally be necessary. In 9 of the 45 cases, there was definite sellar enlargement. Three of the meningiomas showed calcifications.

Seven roentgenograms; 1 drawing.

GEORGE REGNIER, M.D.
University of Arkansas

Agenesis of the Septum Pellucidum with Porencephaly. G. Canossi and C. Pasquinelli. Radiol. med. (Milan) **38:** 825–828, September 1952. (In Italian)

Agenesis of the septum pellucidum is frequently associated with other malformations such as hydrocephalus, agenesis of the corpus callosum, agenesis of the fornices or of the olfactory bulbs, syringomyelia, and spina bifida. The association of the agenesis of the septum pellucidum with porencephaly is rare.

The authors present a case which they believe to be the second recorded so far. The article is illustrated by four excellent encephalograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Tumors of the Gasserian Ganglion. Tumor of the Left Gasserian Ganglion Associated with Enlargement of the Mandibular Nerve. A Review of the Literature and Case Report. Henry M. Cuneo and Carl W. Rand. J. Neurosurg. **9:** 423–431, September 1952.

Tumors of the gasserian ganglion may be either primary or secondary. Endothelioma is the most common type of primary tumor, followed by fibrosarcoma and neurofibroma; other types are extremely rare. Aneurysms of the internal carotid artery may produce symptoms similar to those of tumors.

Pain occurs when the gasserian ganglion is primarily involved and is usually absent when the tumor arises in the sensory root. The onset of pain in the distribution of the fifth nerve, later decreasing or disappearing, should make one suspect extension of the tumor from the ganglion along the sensory root into the posterior fossa. Lower cranial nerve palsies and cerebellar or cerebral peduncle signs are suggestive of involvement of the posterior fossa by the tumor.

It may be difficult to distinguish between acoustic neurinoma and tumor of the fifth cranial nerve root. The degree of deafness with eighth nerve tumor and vestibular loss is greater than the degree of fifth nerve sensory loss on the side of the lesion. In tumors involving the fifth nerve, the degree of objective sensory loss is not always greater than the degree of deafness. Sensory changes may be lacking entirely, even when the ganglion has been almost completely destroyed. Usually paralysis of the motor root can be demonstrated, and at times involvement of the third and fourth cranial nerves, which are in close proximity to the ganglion, will appear in the presence of a tumor of the latter.

An unusual case of tumor involving the gasserian ganglion and the mandibular and maxillary divisions of the trigeminal nerve is reported. One can only speculate as to whether the tumor arose primarily in the ganglion and subsequently spread along the entire mandibular division, later involving the maxillary division, or arose primarily in the mandibular division and later involved the gasserian ganglion. The pathological diagnosis was probable malignant schwannoma of the mandibular nerve, involving the gasserian ganglion. Serial roentgenograms of the mandible show the rapidity with which this tumor invaded the entire mandibular canal, including the mental foramen, in a period of about fifteen months.

Five roentgenograms; 1 photomicrograph.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

The Ocular Complications of Carotid Angiography. The Ocular Signs of Thrombosis of the Internal Carotid Artery. Frank B. Walsh and George W. Smith. J. Neurosurg. **9:** 517–537, September 1952.

Cerebral angiography often is essential to the diagnosis of thrombosis of the internal carotid artery. The ocular manifestations are the subject of this paper. Part I concerns the symptoms associated with angiography, while Part II takes up the ocular symptomatology in general, namely, homolateral blindness, retinal hemorrhages, pain in the eye, hemianopsia, pupillary changes, ophthalmoplegia, and papilledema. Only Part I will be abstracted here.

The ophthalmic artery can be identified in about one-half of the angiograms taken within two seconds after injection of Diodrast. In lateral films taken about five and one-half seconds after injection a thin crescent of opacity is seen to develop in the outer two-thirds of the orbit (Schurr: Brit. J. Ophthal. **35:** 473, 1951). This crescent probably represents filling of the choroidal plexus within the eye.

The symptomatology associated with carotid angiography includes: (1) homolateral burning sensation (often painful) occurring at the time of injection; (2) a flash of light at the time of injection, probably due to retinal irritation; (3) transient pupillary dilatation at time of injection, observed in 25 per cent of cases; (4) momentary narrowing of the retinal vessels followed by widening; (5) transient petechial hemorrhages in skin of the face and about the eye homolateral to the injection, in the conjunctiva, and in the retina; (6) transient hemiparesis and aphasia; (7) transient blindness or changes in visual acuity. In the cases reported impairment of vision occurred after an interval of hours following the injection of the contrast medium. The visual loss may be explained on a basis of either retinal arterial spasm or lodgment of an embolus. The episodes of blindness have not been proved to be dependent on the injection of the contrast medium. One case is reported with immediate loss of vision following angiography; the blindness arose in this case as a result of the development of bilateral homonymous hemianopsia, possibly due to digital compression of the contralateral carotid artery at the time of injection.

The paper includes 12 illustrative case reports, of which 4 are in Part I.

Four roentgenograms; 2 diagrams; 4 visual field charts.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Contrast Investigations on the Effect of Carotid-Jugular Fistulae in Children with Cerebral Lesions. Harry Larsson and Imre Selley. Acta radiol. **38:** 173–186, September 1952.

In a comprehensive study of the cerebral circulation in 14 children with carotid-jugular anastomosis, preoperative and postoperative angiography and direct sinography led to the following observations:

(1) A predominantly right-sided drainage from the superior sagittal sinus cannot be assumed. Preoperative sinography will give information which will prove useful in the choice of the side of surgical approach. Postoperatively, however, the drainage remains unchanged.

(2) Contrast medium introduced preoperatively into the internal jugular vein in an attempt at retrograde sinography could not be forced into the superior sagittal sinus. Following carotid-jugular anastomosis, a slight filling of the intracranial venous system was obtained, but still no medium entered the sinus. Postoperative carotid angiography failed to demonstrate medium in the sagittal sinus or cortical veins when done either at the time of or some weeks after the operative procedure.

(3) Supplemental oxygen concentration studies confirmed the above findings, indicating that reversal of the

circulation could not be achieved with carotid-jugular anastomosis.

Twelve roentgenograms; 2 tables.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Traumatic Internal Carotid Artery Thrombosis Secondary to Nonpenetrating Injuries to the Neck. A Problem in the Differential Diagnosis of Craniocerebral Trauma. Richard C. Schneider and Lloyd J. Lemmen. J. Neurosurg. **9**: 495–507, September 1952.

In patients who have concomitant injuries of the head and neck the physician's attention is directed to the cranium when neurologic symptoms are present. This is particularly true when the trauma to the neck is of a blunt non-penetrating type and the neurologic manifestations simulating severe craniocerebral injury are not recognized as arising from thrombosis of the internal carotid artery.

Five cases of concomitant head injury and traumatic internal carotid artery thrombosis of this type were found in the literature. The authors review these and add 2 similar cases. The clinical findings in their cases simulated epidural or subdural hematoma. In one case the diagnosis of internal carotid thrombosis was made clinically because of right supraclavicular contusion, the relatively alert state of mind initially compared to the degree of neurologic disability, and the differences in the retinal artery pressures. The diagnosis was confirmed by carotid angiography. In the second case thrombosis of the internal carotid artery was not considered in the differential diagnosis. Since no surface lesion could be demonstrated by burr holes and no intracerebral hematoma in the right hemisphere could be localized by the ventriculogram, an arteriogram was obtained, which revealed the thrombosis of the internal carotid artery. Diagnosis in this instance could be made only by the contrast study, since there was no demonstrable change to palpation of the carotid pulse in the neck.

The authors recommend the open method of arteriography. This allows direct visualization of the internal carotid artery, permitting more accurate injection, and makes possible an estimate of the degree of injury to the vessel and surrounding tissues. If thrombosis is demonstrated, cervical sympathectomy may be done immediately. Bilateral angiography is contraindicated in traumatic occlusion of the carotid artery, since the collateral circulation is probably already under an acute strain.

Treatment of carotid arterial thrombosis should be directed toward increasing the blood flow through the collateral channels by cervical sympathectomy. Papaverine as a supplementary vasodilator should be administered.

Four roentgenograms; 3 photographs.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Aneurysm of Anomalous Ophthalmic Artery Presenting in the Sphenoid Sinus and Simulating an Aneurysm of the Internal Carotid Artery on Routine Arteriography. Gordon J. Kinley and David S. Leighninger. J. Neurosurg. **9**: 544–547, September 1952.

A 42-year-old colored female sustained multiple facial lacerations, bilateral fractures of the mandible, and a compound comminuted depressed fracture of the right frontal bone involving the entire supraorbital ridge, right frontal sinus, and roof of the orbit. The right eye was blind. Funduscopic examination showed venous engorgement but no evidence of retinal hemorrhage. Twenty-three days following operative repair of the lesions, the patient was discharged from the hospital, with anesthesia and a soft depression of the right forehead, blindness of the right eye, and weakness of the right third cranial nerve. During the second month following surgery three episodes of epistaxis occurred. Examination on readmission showed the source to be the sphenoid sinus, cannulation of which produced brisk arterial bleeding.

Right percutaneous arteriography revealed an ovoid mid-line opacity below and anterior to the sella turcica which apparently arose from the right internal carotid artery. The margins of this opacity were sharply defined. It had no apparent venous exit. In view of these observations, a diagnosis of aneurysm was made. An oblique view showed an elongated stalk connecting the opaque area with the internal carotid artery close to the posterior genu.

The coincidence of blindness, optic atrophy, and aneurysm of the ophthalmic artery following the accident suggests the possibility of an unrecognized fracture involving the lesser wing of the right sphenoid, optic foramen, and adjacent sphenoid sinus.

Five roentgenograms.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Ossifying Fibroma of the Ethmoid, with Case Report. Arthur Dintenfass, Leonard S. Ellenbogen, and Matthew S. Ersner. J. M. Soc. New Jersey **49**: 386–388, September 1952.

A case is reported of benign ossifying osteoma of the ethmoid sinus in a 25-year-old female who had been treated for sinusitis for thirteen years. The diagnosis was not suspected until established by roentgen examination of the sinuses. Transillumination was normal. The tumor was excised and four years later there was no roentgen or clinical evidence of recurrence.

The authors state that the diagnosis of such a tumor is readily made by roentgen examination, which shows dense tumefaction in a paranasal sinus, with pressure effects on surrounding osseous structures. A review of the literature indicates that differentiation from a malignant growth is established by the absence of bony destruction or infiltration of osseous walls. Most of the tumors arise near centers of intracartilaginous ossification (50 per cent frontal sinuses, 40 per cent ethmoid). The most frequently invaded area is the orbit, with orbital pain and epiphora. The nasal septum may be deviated, causing obstruction. Invasion of the dura is a late manifestation.

The need for careful x-ray examination of the sinuses in cases of obscure sinus pain or recurrent attacks of apparent sinusitis which do not respond to treatment is stressed. This may result in early diagnosis and save the patient many years of futile therapy, especially as the findings on routine ear, nose, and throat examinations may be normal.

The treatment of benign ossifying osteoma of the sinuses is complete surgical excision.

One roentgenogram; 1 photomicrograph.

GEORGE A. SHIPMAN, M.D.
New Orleans, La.

The Tomographic Appearance of the Larynx. Comparative Roentgen Observations in 100 Cases of Cancer. Z. Zsebök. Radiol. Clin. **21**: 307–316, September 1952. (In German)

Tomography of the larynx affected by malignant disease is routine at the Second Surgical University Clinic of Budapest. Two transverse levels (0.5 cm. and 1.0 cm.) are examined during phonation of "u" and "o" for best visualization of the sinus of Morgagni and evaluation of mobility. Tracheotomy tubes are removed prior to filming.

One hundred patients with cancer have been examined by this method. The surgical specimen, whenever obtained, showed an exact coincidence with the tomogram.

Eight tomograms; 9 drawings.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Chondrosarcoma of the Larynx. Harvey H. Sirota and Alfred Hurwitz. Arch. Otolaryng. **56**: 290–293, September 1952.

Only 4 cases of chondrosarcoma of the larynx have been recorded in the literature. The authors report a fifth. A 62-year-old man was admitted to the hospital with hoarseness, stridor, and dyspnea of one month duration. No mass or lymph nodes were palpable on physical examination. Laryngoscopy disclosed a hard smooth tumor, with intact mucosa, occupying the posterior third of the glottic chink. The larger portion of this mass was on the left side, partially encroaching upon the left vocal cord. X-ray examination revealed a mass in the posterior larynx which displaced the airway anteriorly and narrowed the air passage. Deposits in the tumor were suggestive of calcium. A barium swallow showed no obstruction or delay, and the mucous membrane appeared normal. Histologic examination of the specimen obtained at total laryngectomy disclosed a chondrosarcoma of the larynx. The patient made an uneventful recovery.

The authors state that a diagnosis of cartilaginous tumor of the larynx should be considered when an area of tumefaction is demonstrated roentgenologically and when at laryngoscopy a subglottic lesion proves difficult to subject to biopsy because of its gritty nature. Radical extirpation of such tumors, as the primary operation, whether they are chondromas or chondrosarcomas, is emphasized as the procedure of choice.

One roentgenogram; 2 photomicrographs.

THE CHEST

Bronchography in Infants and Children. Robert E. Priest. Ann. Otol., Rhin. & Laryng. **61**: 651–655, September 1952.

The author describes a technic which has yielded excellent bronchograms in infants and children and seems to fulfill all safety requirements. Anesthesia is induced in the bronchoscopic room, usually with Avertin, reinforced by topical application to the tracheobronchial tree of 2 to 4 per cent cocaine in aqueous solution after aspiration of endobronchial secretions through the bronchoscope. After bronchoscopy, a plastic tube is introduced through the bronchoscope into the section of the lung to be first examined bronchographically. The bronchoscope is then withdrawn, leaving the tube in place, and an endotracheal tube such as is ordinarily used for endotracheal anesthesia is passed through the larynx alongside of the plastic tube. The contrast medium is introduced through the plastic tube and pulmonary ventilation is controlled by the anesthesiologist through the endotracheal anesthesia tube. When a roentgenogram is to be made, the anesthesiologist "holds the patient's breath" by compression of the bag of the anesthesia machine, allowing the breathing to start again spontaneously or breathing manually for the patient after the picture is obtained. Proper coating of the bronchi with the contrast medium, the making of spot films, and positioning are the concern of the radiologist and his assistants. Injection of the contrast material and positioning of the tube through which it flows are in the hands of the bronchologist.

Three illustrations.

A Spirographic Test of Bronchial Permeability: The Relation of Pulmonary Capacity Utilizable on Effort to Vital Capacity. P. Drutel and J. Dechoux. J. franç. de méd. et chir. thorac. **6**: 517–542, 1952. (In French)

One of the first tests of pulmonary ventilation to be developed was the determination of vital capacity. Several tests have been added to this in an attempt to study the respiratory debit. One of the most widely accepted of these tests is the determination of the maximum breathing capacity per minute. More recently the testing of pulmonary capacity utilizable on effort (C.P.U.E.) has been evaluated, and this determination may prove to be more useful than that of the maximum breathing capacity per minute.

The C.P.U.E. is the gaseous volume expired in the course of the first second of a forced maximal expiration following a complete inspiration. Its determination is of twofold interest: (1) Its absolute value permits appreciation of the maximum ventilatory possibilities of a subject. (2) Its relation to the corresponding value of the vital capacity gives evidence of disturbances of bronchial permeability and of alveolar elasticity.

The C.P.U.E. increases with age in normal subjects. From eight to fifteen years its value in boys is 1,400 to 3,000 cm^3. and in girls 1,200 to 2,500 cm^3. In adults the average is 3,000 to 4,000 $cm.^3$

The relation C.P.U.E. $\times$ 100/C.V. has been used to correlate values of the C.P.U.E. and vital capacity with pulmonary function. In normal subjects this value is 80 per cent. In emphysematous bronchitis the vital capacity may remain essentially normal, but the C.P.U.E. is diminished and therefore the ratio given is smaller than normal. In rigidity of the thoracic cage and in pulmonary emphysema vital capacity is reduced. The C.P.U.E., however, varies in these two conditions, so that the ratio expressed above is normal in the former and reduced in the latter.

Six graphs; 3 tables.

CHARLES M. NICE, M.D.
University of Minnesota

Agenesis of the Lung with Tracheal Stenosis. Case Report. F. Johnson Putney and William H. Baltzell. Ann. Otol., Rhin. & Laryng. **61**: 677–680, September 1952.

The diagnosis of agenesis of the lung is made by roentgenographic, bronchographic, and bronchoscopic examinations. The authors report the case of a child one year of age in whom roentgen examination disclosed no aeration of the left lung, a rudimentary left sixth rib, and a compensatory emphysema of the right

lung. Narrowing of the trachea prevented insertion of the bronchoscope beyond 3 to 4 cm. A bronchogram revealed a normal tracheal bifurcation and a rudimentary left bronchus ending blindly.

Two roentgenograms; 1 photograph.

The Diagnosis and Management of Asymptomatic Isolated Intrathoracic Nodules. Sidney E. Wolpaw. Ann. Int. Med. **37**: 489–505, September 1952.

A varied assortment of symptomless intrathoracic conditions has been discovered on mass chest x-ray surveys. The isolated well defined nodules, often of small size in this group, offer considerable difficulty in diagnosis and therapy. Should these nodules happen to be inflammatory in origin, or benign tumors, there is usually no urgency as to their recognition and treatment. If they represent a phase in the early development of a carcinoma, however, incorrect diagnosis and improper management may prove disastrous. The asymptomatic character of the nodule, the absence of physical signs, and the apparent good health of the patient do not mean that the abnormality is insignificant and does not require treatment.

An analysis of a group of 25 silent circumscribed nodules in apparently normal people, observed by the author in recent years, revealed 6 bronchogenic carcinomas (25 per cent), 7 tuberculomas, 2 bronchial adenomas, 2 hamartomas, 2 metastatic carcinomas, 1 fibroma, 1 pericardial cyst, 1 arteriovenous aneurysm, 3 granulomas of undetermined etiology.

When circumscribed nodules have been detected, exact diagnosis has rarely been possible, despite intensive study. No definite criteria can be considered reliable in differential diagnosis. A variety of pathologic conditions may simulate one another in size, definition, and density, as indicated by 4 cases reported in detail. Of the various diagnostic methods utilized, few short of exploratory thoracotomy have been of any genuine help. Skin tests, whether negative or positive, cannot differentiate between granuloma and tumor. Bronchoscopy has seldom been of aid, due to the small size of the nodules and their frequent peripheral location beyond the range of bronchoscopic visualization. Bacteriologic examination of sputum and gastric material is infrequently positive for tubercle bacilli or fungi. A lengthy delay for cultural studies, guinea-pig inoculation or repeated examinations, is hardly justified. The aspiration biopsy of nodules as small as those demonstrated is difficult and not without considerable risk. It has been abandoned as a diagnostic measure. Sputum and bronchial aspiration cytology may be diagnostic if tumor cells are found, which has occurred infrequently.

Occasionally, angiocardiography has demonstrated an arteriovenous aneurysm. The only other x-ray finding of some practical value is the laminagraphic demonstration of a central core of calcification indicative of a tuberculous or histoplasmic lesion. In some cases certain benign tumors such as hamartomas and chondromas may also show small foci of calcification.

To watch a malignant growth increase in size under observation may be dangerous to the patient and embarrassing to the physician. During such a waiting period, metastases may occur or an operable lesion may become inoperable.

If exact diagnosis of a circumscribed nodule is impossible, then prompt exploratory thoracotomy, excision of the lesion, and its accurate microscopic identification must be undertaken. Exceptions to this principle have been made, especially in the case of nodules with laminated or central cores of calcification. Advanced age, impaired pulmonary function, or the presence of other disease may also contraindicate a recommendation for exploration.

At the present time the risk of exploration and local excision of an asymptomatic nodule is slight. The risk in delaying operation may be great. The thoracic surgeon has the responsibility for the choice of procedure which will best serve the interests of the patient.

Fifteen roentgenograms.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Obscured Bronchogenic Carcinoma. Report of a Case with Necropsy. Isaac Epstein and Marjorie J. Williams. Dis. of Chest **22**: 213–218, August 1952.

A 50-year-old Negro entered the hospital in 1949 with a history of intermittent hemoptysis dating back seven years. In 1941 he had sustained multiple injuries to the chest and subsequently required rib resection for empyema of the right hemithorax. The first roentgenogram obtained in 1949 showed old rib fractures on the right and areas in the right lung field suggesting emphysematous bullae. Investigations for tumor and tuberculosis were negative and the patient was discharged. He returned six months later showing an obvious density in the right upper lobe. A bronchoscopic biopsy showed no evidence of cancer, but because of the radiologic findings the patient was explored. Though no tumor was found, the right lung was removed, because it showed chronic fibrous pleuritis, emphysema, and bronchiectasis. Three months after surgery a mass appeared in the right flank. Exploration revealed a large retroperitoneal hematoma. Following this, phlebothrombosis of the right iliac and femoral veins developed, and the patient died shortly thereafter.

At postmortem examination, a massive retroperitoneal hemorrhage was found, due to adrenal metastasis. The primary lesion was an anaplastic carcinoma of the right main bronchus, manifested grossly by roughening of the mucosa. This lesion was present, but occult, at the time of the pneumonectomy, the lung having been removed distal to the tumor site. Re-examination of the resected specimen showed minute foci of metastasis around the blood vessels and at the margins of the inflammatory necrosis.

This case is instructive because it illustrates the difficulty of making an early diagnosis of bronchogenic carcinoma in the presence of pre-existing chronic pulmonary disease. The difficulty was increased by the minuteness of the primary lesion and by the prominence of the symptoms resulting from metastasis.

Four roentgenograms; four photomicrographs.

DAVID D. ROSENFELD, M.D.
Fontana, Calif.

Lingular Disease. William A. Hopkins and Ted F. Leigh. Dis. of Chest **22**: 171–182, August 1952.

The authors believe that isolated disease of the pulmonary lingula is more common than is usually suspected. They have recently encountered 32 cases, 15 of bronchiectasis and 4 of carcinoma, with the remainder distributed among pneumonia, tuberculosis, chronic

granuloma, abscess, and chronic interstitial pneumonitis. The clinical picture in lingular disease due to bronchiectasis is characterized by moderately productive cough and fatigue. In the carcinoma group, cough fatigue, weight loss, and chest pain were the most common findings.

Roentgenologically, one of the features of disease in the lingula is a partial or complete obliteration of the normally sharp left cardiac border. In the surgically resected specimens the reason for this abnormality proved to be adhesions between the visceral pleura and the parietal pericardium. In acute lesions the left cardiac border commonly shows poor definition rather than obliteration. With complete healing, the sharply defined border returns.

The volume of the lingular segment is usually normal in the presence of acute disease. In chronic disease, where fibrosis and atelectasis occur, the segment shrinks toward the left hilus. In both of the authors' cases in which carcinoma was found in the lingular orifice, the segmental volume was increased.

Failure of lingular filling on bronchography is an important finding if not the result of a technical error. It is usually due to obstruction by secretions, stricture, or neoplasm.

The authors stress the fact that lingular disease can be demonstrated on plain roentgenograms of the chest (postero-anterior and lateral projections). Identity of the lesion is confirmed by bronchoscopy, bronchography, or exploration. Because of the possibility of carcinoma, all cases of lingular disease should be carefully studied.

Ten roentgenograms; 2 tables.

DAVID D. ROSENFELD, M.D.
Fontana, Calif.

Stenosis of the Middle Lobe Bronchus. Etiology and Results. R. H. Jenny. Schweiz. med. Wchnschr. **82:** 869–872, Aug. 30, 1952; 899–903, Sept. 6, 1952. (In German)

Temporary or permanent stenosis of the bronchus of the middle lobe of the right lung is not infrequent. In younger persons the diagnosis is relatively simple. In patients of the cancer age, however, the differential diagnosis may be very difficult.

For the exact localization of a pulmonary lesion, definite knowledge of the anatomical factors is indispensable not only for the surgeon but also for the internist and radiologist. Unfortunately, even now many textbooks contain incorrect data regarding the distribution of the bronchi. It must also be borne in mind that in growing children the structure, lumen, and proportion of trachea, bronchi, and lung tissue are continuously changing. In the newborn the elastic tissue beneath the epithelium, the basal cells, and the basal membrane is only slightly developed and only gradually increases in strength. Therefore, in children an increased vulnerability of the bronchi toward pressure or infection is noted.

The lymph nodes in the region of the middle lobe bronchus are of special interest since they are affected not only in pathologic changes of the middle lobe but also in diseases of the right lower lobe and of the anterior segment of the upper lobe. Tuberculosis is the most frequent cause of lymph node involvement producing temporary or permanent stenosis of the bronchus of the middle lobe and so indirectly effecting changes in the lobe itself. Very marked node enlargement may occasionally be seen in pertussis and in acute pneumonitis. During a period of five years the author observed at the 2nd Surgical University Clinic of Vienna 34 patients with pathologic changes in the right middle lobe which were due to lymph-node enlargement. Among 1,040 cases of bronchial carcinoma, only 11 central carcinomas originating from the middle lobe bronchus were observed. Occasionally bronchial stenosis due to lymph-node compression may become manifest several years after the primary infection, as is demonstrated by 2 of the author's cases.

Among 58 cases of solitary or multiple pulmonary cysts observed by the author, in only 4 were the cysts in the middle lobe.

Considering the fact that in a series of 1040 malignant lung tumors only about 1 per cent had their origin in the middle lobe, occlusion of the middle lobe bronchus by lymph-node compression or cicatrization is clinically considerably more important. The 11 patients suffering from central carcinoma originating from the right middle lobe were all men of the age group forty-nine to sixty-four years. In 6 of these cases the diagnosis could be verified by bronchoscopy and by operation. The remaining 5 patients (2 of whom showed bony metastases on admission to the hospital), died five to nine months after observation of the first symptoms. Stenosis of the bronchial lumen by a benign tumor is even more infrequent. In only 1 case, in a 38-year-old woman, a malignant adenoma was diagnosed producing stenosis of the bronchus and necessitating lobectomy of the right middle and lower lobes.

In addition to bronchoscopy, tomography and bronchography are valuable in the radiological diagnosis of bronchial stenosis of the middle lobe.

Nineteen roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

On Middle Lobe Atelectasis of Brief Duration. P. Jeanneret and E. Sommer. Radiol. clin. **21:** 332–336, September 1952. (In German)

Two cases of middle lobe atelectasis are presented. In the first, in a six-year-old boy with fibrinous bronchitis, radiographic signs disappeared twenty-four hours after bronchoscopy and bronchial aspiration. In the other, in a fourteen-year-old girl seen shortly after appendectomy, the deep inspiration and forced coughing incident to fluoroscopy are made responsible for the improvement, which could first be demonstrated five hours later.

The difficulty of differentiating middle lobe atelectasis from encapsulated interlobar effusion and from middle lobe infiltration is discussed. Multiposition filming, utilizing the influence of gravity upon the configuration of chest shadows, is recommended, but the most helpful sign—at least in the two cases reported here—is Hitzenberger's nasal snuff test (*Schnupfversuch*), in which the mediastinum is said to "jerk" toward the affected side if atelectasis is present. The test is not described.

Five roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Virus Influenza A′ Infection with Pulmonary Manifestations. Jordan M. Scher and Edward Jaruszewski. Arch. Int. Med. **90:** 201–216, August 1952.

The criteria for the diagnosis of influenza virus

infection are given by the authors as follows: (1) presence of serologic evidence of recent infection by the virus; (2) demonstration of a clinical course compatible with such an infection; (3) absence of bacterial pathogens as etiologic agents. This diagnosis was made in 76 patients at the U. S. Naval Hospital in Philadelphia during the first three months of 1951. Most of these were young males. Of this group, 32 per cent presented pulmonary infiltration in the roentgenograms, and in these patients the cough was more severe and harsh. The infiltrates were found in the middle and lower portions of the lungs and sometimes persisted for as long as fifteen days. Defervescence was found to be the same with and without antibiotic medication, and whether or not pulmonary infiltration was present. The symptoms, signs, and roentgenographic findings must be differentiated from primary atypical pneumonia.

Five roentgenograms; 1 graph; 6 tables.

PAUL W. ROMAN, M.D.
Baltimore, Md.

The Coronary Circulation in Patients with Severe Emphysema, Cor Pulmonale, Cyanotic Congenital Heart Disease, and Severe Anemia. Henry A. Zimmerman. Dis. of Chest **22:** 269–273, September 1952.

Using a method of injection of the coronary arteries with a barium latex compound previously described (Scott *et al.:* Am. Heart J. **38:** 881, 1949. Abst. in Radiology **55:** 777, 1950), the authors studied the coronary circulation in cases of cor pulmonale, cyanotic congenital heart disease, and severe anemia. In a series of 165 patients, 13 were found in whom a very significant increase in the small ramifications of the coronary arteries was demonstrable. Experimental studies to date do not afford an explanation of the various factors involved in the development of this anastomotic circulation. The author suggests that the primary factor may be the increased local cardiac need or perhaps myocardial anoxia, regardless of whether that need is occasioned by increased work of a part of the myocardium, coronary artery insufficiency, or decrease in the amount of circulating oxygenized hemoglobin from whatever cause.

Two roentgenograms.

Tomographic Analysis of Arteriovenous Aneurysms in the Lung. Report of a Case Confirmed at Autopsy. Herman Lodin. Acta radiol. **38:** 205–211, September 1952.

Angiography allows the best detailed study of the vessels involved in a pulmonary arteriovenous aneurysm. Tomography, however, can be extremely valuable, as is indicated by the case described. Postmortem contrast studies completely confirmed, with excellent correlation, the tomographic findings obtained before death.

A twenty-six-year-old male had had intermittent cyanosis, clubbing of the fingers and a systolic murmur in the right second anterior interspace since birth, presumably on the basis of congenital heart disease. Routine chest radiographs disclosed a right hilar density plus an elongated opacity extending down the right cardiac border, which appeared lobulated on the lateral view. Ribbon-like shadows connecting these opacities to the hilus suggested arteriovenous aneurysms. Besides confirming the impression of two such lesions, tomograms also disclosed four more, not suspected on the routine films.

Of particular interest in review of the case is the statement that vessels which proceed toward the periphery without normal narrowing are pathognomonic of an arteriovenous shunt.

Eleven roentgenograms.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Aberrant Intrathoracic Goiter. Harris S. Holmboe. Permanente Found. M. Bull. **10:** 266–270, August 1952.

The incidence of true aberrant intrathoracic thyroid is stated to be approximately 0.5 per cent of all operated goiters. A case is described in which a routine chest film revealed a mediastinal mass. Physical examination showed nodular enlargement of the cervical thyroid with deviation of the trachea to the right. The superior vena cava was also displaced to the right and anteriorly, and the esophagus to the right and posteriorly. No movement of the mass in the mediastinum could be demonstrated on swallowing nor could any signs of pulsation be detected.

Radioactive iodine uptake study failed to indicate the presence of any thyroid tissue below the sternum. Despite this negative evidence and the location of the tumor in the posterior superior mediastinum, an unusual site for an aberrant thyroid, it was felt by the radiologists that they were dealing with an intrathoracic goiter. One year later the tumor was removed. It weighed 114 gm. and measured 8.0 × 7.0 × 3.5 cm. The pathologic diagnosis was aberrant mediastinal thyroid tissue.

Three roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

The Present Status of Electrokymography. A Review. Howard E. Heyer and Bert R. Boone. Am. Heart J. **44:** 458–480, September 1952.

This paper is a review of the knowledge gained concerning cardiac activity by the use of electrokymography and points out its possible clinical uses and limitations. A very extensive bibliography is included.

Thirteen figures; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

Electrokymographic Studies of the Left Auricular Movements in Mitral Stenosis and Insufficiency. Ture Andersson. Acta radiol. **38:** 81–97, August 1952.

In this paper, which is a preliminary report of a more extensive study, only changes in the electrokymogram of the left auricle are discussed in detail. This report is based upon studies in 90 cases of mitral valvular disease with sinus rhythm.

The electrokymographic curve is an expression of the movement of the cardiac contour at a certain point, or over a small area, and is composed of several different components dependent upon changes in volume, movements transmitted between the chambers of the heart, movements of the heart as a whole, movements of the great vessels, changes in intrathoracic pressure, and varying body positions.

In mitral valve disease, pronounced and typical changes are observed in the curves of the left auricle. Stenosis and insufficiency each present characteristic curves and in most cases they appear simultaneously.

In mitral stenosis the characteristic tracing is an accentuation of the falling portion of the left auricular curve, which is dependent upon auricular contraction. This change is due to the filling up of the auricle by blood which cannot pass readily through the stenotic valve opening. Five case histories are given showing this (and other secondary changes).

With insufficiency, blood is forced back into the left auricle with ventricular systole, causing a dilatation of the auricle, which appears as a rise in the curve. Pure insufficiency appeared in only a few of the cases studied. One case is presented showing the changes found in mitral insufficiency.

The actual technic of electrokymography and the apparatus are only mentioned. They have been described by this author as well as others in previous reports.

Thirteen electrokymograms.

J. B. SCRUGGS, M.D.
University of Arkansas

Rheumatic Heart Disease with Calcification of the Left Auricle. Report of Two Cases with Review of the Literature. Herman Ruskin and Eric Samuel. Am. Heart J. **44**: 333–343, September 1952.

Calcification in the left auricular wall is rare and, in the majority of reported instances, it has been associated with rheumatic heart disease involving the mitral valve. Eighteen cases have been recorded in the literature, and 2 additional cases are presented in this paper.

The changes in the left auricle consist of subendocardial plaques, endocardial fibrosis, connective-tissue hyperplasia, and Aschoff nodules. The site of predilection for endocarditis is the posterior wall of the auricle above the posterior mitral leaflet. The auricular calcification is endocardial, the extent varying from plaques in the posterior wall to involvement of the entire wall.

Adequate clinical data are available in 19 cases, of which 14 were in women and 5 in men. The mitral valve was involved in all 20 cases, 19 of which had definite stenosis; the aortic valve was also affected in 8. Tricuspid disease was diagnosed correctly during life in 3 and found at autopsy in 2 cases.

Auricular fibrillation was present in 18 cases. Congestive cardiac failure was found in 16 cases.

The radiologic appearance of left auricular calcification is now well established. The calcification is generally curvilinear in character and occupies a position posterior to the base of the heart. As it is associated with mitral valve disease, some enlargement of the left auricle is usually present and consequently the arc of calcification is larger than one would anticipate. Very occasionally a mural thrombus in the left auricle becomes calcified but massive thrombi do not calcify.

Patients with left auricular calcification appear to fare somewhat better than the average adult with mitral stenosis. The reason for this is not understood.

[Curry, Lehman, and Schmidt, in a paper recently published in RADIOLOGY (**60**: 559, April 1953), reported a series of 8 cases of left atrial calcification, and 2 further examples are reported in the present issue (see Hemley, Schwinger, and Harrington, p. 49)—ED.]

Eight roentgenograms; 2 electrocardiograms; 2 tables. HOWARD L. STEINBACH, M.D.
University of California

Patent Ductus Arteriosus with Partial Reversal of the Shunt. A Study of Two Cases. T. H. Bothwell, B. Van Lingen, Joanna Whidborne, J. Kaye, M. McGregor, and G. A. Elliott. Am. Heart J. **44**: 360–371, September 1952.

Two cases of patent ductus arteriosus with intermittent reversal of the shunt are described. The bidirectional flow was demonstrated during life by cardiac catheterization, simultaneous right brachial artery and femoral artery blood oxygen analyses, oximetric and dye dilution studies, and by angiocardiography.

To diagnose the condition, three criteria should be satisfied. Features of uncomplicated patent ductus arteriosus must be present, although the typical Gibson murmur is often absent. There must be a degree of pulmonary hypertension sufficient to allow for some reversal of the shunt. A lowering of the oxygen content must be shown in blood from the systemic arterial tree distal to the entrance of the patent ductus arteriosus into the aorta, that is, a regional distribution of the venous blood shunted from pulmonary artery to aorta.

The diagnosis of some reversal of the shunt through a patent ductus arteriosus can be made with certainty in only two ways. First, it may be possible to outline the ductus on angiocardiography, as was done in one of the cases presented by the authors. Such a finding is never seen in cases of uncomplicated ductus arteriosus. Second, the regional distribution of the venous blood shunted from the pulmonary artery into the aorta should be demonstrated There should be a significantly lower oxygen content of blood in the lower limbs as compared with the right brachial artery. In addition, because of the proximity of the left carotid and subclavian arteries to the aortic opening of the patent ductus arteriosus, it is possible to get some venous admixture of blood in both these vessels if there is a reversal of the shunt. This can be demonstrated by oximetric measurements and dye dilution studies.

The operative mortality in cases of ductus arteriosus with intermittent reversal of the shunt is much higher than in uncomplicated cases.

Three roentgenograms; 2 graphs; 1 phonocardiogram; 2 tables. HOWARD L. STEINBACH, M.D.
University of California

Congenital Pulmonic Stenosis with Open Foramen Ovale in Infancy. Report of Five Proved Cases. Richard P. Johnson and Eloise Eberling Johnson. Am. Heart J. **44**: 344–359, September 1952.

Five cases of valvular congenital pulmonic stenosis with open foramen ovale occurring in infants and proved by autopsy are reported. The patients were all girls and their ages were three, four, nine, twelve, and nineteen months. This malformation may prove to be the second commonest cause of cyanotic congenital heart disease, only the tetralogy of Fallot being more frequent.

The syndrome in infants includes early cyanosis, which may clear for a short period, only to return. Polycythemia and clubbing of the fingers and the toes may follow the cyanosis. A precordial systolic mur-

mur of slight to loud intensity is present. Dyspnea occurs in paroxysms and when present is a grave sign.

Roentgenologic examination usually reveals an enlarged heart, with the cardiothoracic ratio between 50 and 70 per cent. The right atrium and right ventricle are increased in size, and the pulmonary artery is dilated. The dilated pulmonary artery shows diminished or absent pulsations. The lung fields are clear; there is a decrease in the pulmonary vascular markings.

The electrocardiogram shows marked right ventricular hypertrophy and P waves are prominent in Lead II.

Correct diagnosis is important so that the proper surgical procedure may be employed to alleviate the symptoms. Pulmonic valvulotomy has resulted in remarkable improvement in most cases. The common "blue baby" operations of Blalock and Potts are not beneficial in pulmonic stenosis with open foramen ovale.

Seven roentgenograms; 2 photographs; 5 electrocardiograms; 2 tables.

HOWARD L. STEINBACH, M.D.
University of California

Radiological Demonstration of Right Pulmonary Vein Opening in the Superior Vena Cava. G. Tori. Radiol. clin. **21:** 336–343, September 1952. (In English)

In a 20-year-old man without cyanosis or other symptoms, a precordial systolic murmur was found incidentally. His blood pressure was 150–170/65–70. An electrocardiogram was normal except for right axis deviation. The clinical diagnosis was interauricular septal defect.

Cardiac catheterization was undertaken, but the tip of the catheter, after entering the superior vena cava, curved to the right instead of continuing straight downward to the right auricle. Fifteen cubic centimeters of 70 per cent Pielosil was then injected through the catheter, outlining an anomalous vessel extending from the superior vena cava into the periphery of the right lung and apparently representing a pulmonary vein. Subsequent angiocardiography through a catheter with its tip in the right auricle showed no morphological alteration in either the right ventricle or the pulmonary artery. No interauricular defect was demonstrated.

Oxygen concentration determinations were as follows: superior vena cava, 12.8 volumes per cent; right auricle, 14.2; right ventricle, 14.8; pulmonary artery, 14.5; right inferior pulmonary vein, 15.8; femoral artery, 16.0.

Six roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

THE BREAST

Secretory Disease and Plasma Cell Mastitis in the Female Breast. Roentgenologic and Pathologic Studies. J. Gershon-Cohen and Helen Ingleby. Surg., Gynec. & Obst. **95:** 497–504, October 1952.

Secretory disease and plasma-cell mastitis are seldom diagnosed, even by pathologists. Roentgenologic studies have proved especially valuable in the elucidation of these conditions and in demonstrating that they are one nosologic entity. Plasma-cell mastitis is a common complication of secretory disease. In the authors' experience every case of secretory disease or without plasma-cell mastitis that came to operation was shown by roentgenology to be bilateral.

Among 300 cases of breast disease examined, there were 24 of secretory disease. The patients were all married, and the authors feel that this condition occurs rarely in single women. All but 1 had nursed their children; 5 had puerperal mastitis. Sixteen cases were complicated by plasma-cell mastitis. In 16 of the 24 cases secretory disease was found in the nipple area. The most characteristic manifestations are painful swelling and nipple discharge. In 19 cases a mass varying in size from a few millimeters up to 4 cm. in diameter was present.

"The roentgenologic findings in secretory disease in the older age group to which most of the cases belong are pathognomonic." When in the nipple area, the lesion is easily identified. The ducts leading from the nipple are distended and follow a tortuous course, ending in club-shaped dilatations or flame-like projections. Occasionally a group of ducts may coalesce to form a mass localized to a small area just under the nipple. Plasma-cell mastitis is manifest radiologically as a homogeneous, coarsely tentacled density, with margins extending in flame-like projections along the line of the trabeculae. In younger patients the affected area gives a uniform ground-glass appearance.

Secretory disease is a much milder disorder than its rather bizarre appearance would suggest, and it is only important as the precursor of plasma-cell mastitis. Since the essential feature is differentiation of epithelial cells, followed by degeneration and shedding, carcinoma does not arise in the affected ducts.

Five roentgenograms; 9 photomicrographs.

BERTRAM LEVIN, M.D.
Minneapolis, Minn.

THE DIGESTIVE SYSTEM

Dysphagia Lusoria: An Unusual Case. Bernard M. Wagner and Walter S. Price. Am. Heart J. **44:** 452–457, September 1952.

Dysphagia lusoria is a descriptive term used to describe the syndrome produced by an aberrant right subclavian artery compressing the esophagus. However, any extrinsic cause of tracheo-esophageal obstruction may elicit a similar picture.

An unusual congenital anomaly causing tracheo-esophageal obstruction associated with tetralogy of Fallot is presented. The patient was a 5-month-old girl who had intermittent episodes of cyanosis and dysphagia. Roentgenograms revealed a definite filling defect in the posterior wall of the upper one-third of the esophagus. This defect appeared oblique in its direction, the lower portion of the obliquity being to the left. It was thought that this defect was characteristic of esophageal compression by an aberrant right subclavian artery. A thoracotomy was performed, and an anomalous vessel was ligated. The patient died four hours after the operation.

At autopsy the ductus arteriosus was found arising from the left pulmonary artery and was not patent. The aorta curved to the right so that the first portion of the descending aorta was present to the right of the vertebral column. Arising from the arch of the aorta were four large vessels, namely, the left subclavian, left common carotid, right common carotid, and right subclavian arteries. A small branch from the right subclavian artery passed to the left behind the esophagus to anastomose with the ductus arteriosus. This was the vessel which had caused the defect on the

posterior wall of the esophagus that was demonstrated on the roentgenograms.

One roentgenogram; 1 photograph; 1 drawing.

HOWARD L. STEINBACH, M.D.
University of California

Painful Spasm of the Oesophagus ("Corkscrew" Oesophagus). G. Ismay. Brit. M. J. **2**: 697–698, Sept. 27, 1952.

"Corkscrew" esophagus is a condition in which alternating contractions and dilatations, as a result of multiple segmental esophageal spasms, produce a characteristic tortuous appearance on the roentgenogram. A case is reported in a man of seventy, and it is suggested that the condition is due to degenerative changes in Auerbach's plexus as a result of arteriosclerosis.

Two roentgenograms.

Benign Intramural Extramucosal Tumors of the Oesophagus. A Report of Two Cases. M. K. Kiernan. J. Canad. A. Radiologists **3**: 57–59, September 1952.

Tumors originating in the esophageal wall without involvement of the mucosa are rare; the majority of these are leiomyomas, with cysts of esophageal or bronchial origin next in frequency.

Two cases are presented, in both of which medical attention was sought because of intermittent dysphagia. Radiological examination of the first patient revealed a lobulated filling defect just below the aortic arch level, with partial obstruction. This proved at operation to be due to three separate marble-sized leiomyomas. Some difficulty was encountered in radiological demonstration of the lesion in the second case, three examinations being done prior to surgery. The tumor was a lipoma of the lower esophageal wall, with compression and distortion of the lumen.

Roentgenograms in these cases showed a sharp step-like angle between normal esophagus and the filling defect produced by the tumor, and there was noted a "smear" or "mould" appearance caused by the stretching of the mucosa over the tumor. In both cases there was disturbance of the neuromuscular function, with transient overfilling above the lesion. The author notes that radiological detection of these tumors may be difficult; he suggests that esophagoscopy be done in every case to rule out a lesion involving the mucosa.

Seven roentgenograms.

CARSON R. JONES, M.D.
Atlanta, Ga.

Duplication of the Stomach. Report of the Fifth Case Recorded. Jorge de Castro Barbosa, V. Bicudo de Castro, Nicola Caminha, Candido de Oliveira, and Carlos Ramos. J.A.M.A. **149**: 1552–1555, Aug. 23, 1952.

Duplications of the alimentary tract are usually spherical or elongated hollow structures, which possess a coat of smooth muscle, which are lined by a mucous membrane, and which are intimately attached to some portion of the alimentary tube. Lesions of this type have been encountered at all levels of the digestive tract, from the base of the tongue to the anus. They are frequently known as enterogenous cysts, enteric cysts, inclusion cysts, and gastrogenous cysts. The duplication is not necessarily a perfect replica of that viscus to which it is contiguous. They usually share with the segment, at the area to which they are attached, the same smooth muscle coat. The lining of these hollow structures is usually formed of mucosa or epithelium, similar to that of some portion of the gastrointestinal tract.

It is of practical surgical importance to differentiate duplications of the alimentary tract from lymphatic mesenteric cysts. Cysts can be shelled out easily from the mesentery, without disturbing the neighboring gastrointestinal tract. Duplications and enterogenous cysts usually present no plane of cleavage into which the surgeon can dissect.

Symptoms caused by duplications of the alimentary tract arise from (1) obstruction, (2) distention of the hollow structure, producing extrinsic pressure upon the normal viscus, and (3) vascular obstruction. When such duplications become large enough, they are palpable and give the impression of a smooth rounded mass. Roentgenologic examination with a contrast medium usually permits the conclusion that the mass is intramural and extramucosal.

The authors describe the fifth case of duplication of the stomach recorded in the literature. The patient was a 33-year-old white women who complained of severe epigastric pain and vomiting and who had a large tender mass occupying the whole left upper abdomen. X-ray examination showed a very large extrinsic mass dislocating the stomach anteriorly. At operation a large duplication of the stomach, containing more than 2,000 c.c. of fluid, was partially excised and marsupialized to the anterior abdominal wall. The patient was well fourteen months later.

One roentgenogram.

ALFRED O. MILLER, M.D.
Louisville, Ky.

Carcinoma of the Stomach: Review of 406 Cases Seen from 1940 to 1945: Operability, Resectability and Curability. Charles H. Brown and Charles F. Kane. Gastroenterology **22**: 64–75, September 1952.

In this paper, which is concerned chiefly with observations of operability and curability in a series of 406 cases of gastric carcinoma seen at the Cleveland Clinic, the authors point out the inadvisability of determining operability by roentgen study alone. In 25 of their series the disease was considered too extensive for operation, solely on the basis of the roentgen findings. Two patients who were considered inoperable after x-ray examination responded favorably to roentgen irradiation in small doses. They are believed to have had hypertrophic gastritis or lymphoblastoma. A third patient was considered inoperable in 1945 because of the apparent extent of the disease as evidenced by roentgen examination. She returned in 1951 with increasing gastric symptoms, and a gastric resection was done at that time.

Esophageal involvement, usually diagnosed roentgenologically, was the chief reason for not operating on 19 patients. One of these, in whom the diagnosis was confirmed by biopsy, survived seven years. Involvement of the esophagus is no longer considered a contraindication to surgery.

One graph; 8 tables.

Gastric Carcinoma: A Statistical Study Based on 344 Cases from 1938 through 1947. Edward E. Jemerin and Ralph Colp. Surg., Gynec. & Obst. **95**: 99–112, July 1952.

Carcinoma of the stomach is responsible for one-

fifth to one-third of all carcinoma deaths in the United States. From 1938 to 1948, 344 cases were encountered at the Mount Sinai Hospital, New York, 239 in males and 105 in females. All but 48 cases occurred between the ages of forty-one and seventy years.

Carcinoma may be present in the stomach for a long time before symptoms occur. In this series of cases definite treatment was undertaken as soon as the diagnosis was made, but even then only 46 per cent of the cases were given a chance of cure within the first six months from onset of symptoms.

All patients presented symptoms referable to a gastric lesion, weight loss, pain, indigestion, weakness, vomiting, and anorexia being the most common. Pain was the most frequent presenting symptom and its relationship to food was variable. Hematemesis occurred in only 24 cases, although melena was present in 54 cases. Physical signs, except for the presence of a mass, were frequently of no diagnostic significance. Laboratory data as to anemia, melena, and gastric acidity were also rather non-specific and not to be relied upon for a diagnosis.

The roentgen examination established the diagnosis in most instances, with 239 cases positive for or suggestive of carcinoma. In 24 cases the findings were negative for carcinoma and 54 cases were originally negative but later became positive. In 27 cases there had been no recent x-ray examination. The authors conclude that roentgenography when properly employed offers the best available method for early diagnosis of gastric carcinoma.

Endoscopy provided accurate information in 194 of the 224 cases in which it was attempted (87 per cent), and it should be employed in all cases in which doubt exists after an x-ray study. Negative findings cannot be relied upon, however, because of the difficulties inherent in this method.

The chief problem demanding solution is that of early diagnosis, but at present none can be offered. No reliable criteria differentiating benign from malignant ulcer can be consistently found, and all gastric ulcers with the exception of an occasional small acute lesion that heals promptly should therefore be treated surgically.

In the first five-year period covered by this study 147 cases were explored, definitive surgery with a hope of cure being performed in 65 cases, a resectability rate of 41 per cent. The overall operative mortality was 24 per cent. In the second five-year period 186 patients were operated upon, and in 97 (or 52 per cent) resection was done. The overall mortality was 16 per cent. Increase of resectability was due to technical surgical advances and not to earlier diagnosis, while decreased mortality is attributed to improved supportive care and technics. In the first five-year period 14 patients survived more than three years, representing 21 per cent of the resected cases or 9 per cent of all cases. Only 10 patients were well at five years. In the second five-year period 33 patients or 34 per cent of those in whom resection was done, 17 per cent of the total, were alive at the end of three years. Eighteen patients were alive and well at five years. Definite improvement in survival in the second period is shown despite the extension of criteria for resectability.

The authors found that involvement of the regional lymph nodes reduced the chance for survival by more than half but in itself was no contraindication to resection. Duration of symptoms had less bearing on resectability and survival than the extent and degree of spread of the lesion.

Eight tables.

ROBERT P. BOUDREAU, M.D.
University of Pennsylvania

The Development of Gastric Carcinoma in Pernicious Anemia. John W. Norcross, Stanley E. Monroe, and Belton G. Griffin. Ann. Int. Med. **37:** 338–343, August 1952.

The authors conducted the investigation recorded here because of the reported high incidence of malignant and premalignant lesions of the stomach occurring in patients with pernicious anemia. They studied 233 pernicious anemia patients by one or more roentgen examinations over a number of years. The average follow-up was 5.9 years. The diagnosis of pernicious anemia was applied only when the patient had a macrocytic anemia accompanied by achlorhydria, with response to liver therapy. Four cases of carcinoma of the stomach were discovered, an incidence of 1.7 per cent. All 4 patients had specific symptoms which led to roentgen examination.

From these results, the authors conclude that routine annual roentgen examination of the stomach in patients with pernicious anemia is of doubtful value. However, when symptoms appear, there is no doubt as to the necessity of such examination.

One table.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Shortening of the Lesser Curvature in Gastric Ulcer. Sydney J. Hinds and R. A. Kemp Harper. Brit. J. Radiol. **25:** 451–461, September 1952.

Shortening of the lesser curvature as a complication of chronic gastric ulcer is commonly overlooked. Ten cases are reported, in 7 of which operation has been done.

The shortening, which is secondary to scar formation in the gastric wall or gastrohepatic omentum, causes a typical deformity, drawing the pylorus upward and to the left. If the shortening is sufficiently pronounced, a pouch is formed of the antrum, leading to mechanical stagnation, increasing retention, and gastric irritation. This also probably interferes with healing. Hematemesis appears to be more common in these cases.

Sixteen roentgenograms; 1 table.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Clinical Evaluation of Prolapse of the Gastric Mucosa into the Duodenum. Maurice Feldman, Samuel Morrison, and Philip Myers. Gastroenterology **22:** 80–99, September 1952.

In an earlier paper (Gastroenterology **20:** 90–99, 1952. Abst in Radiology **59:** 776, 1952) the authors discussed the incidence, etiology and roentgen features of gastric mucosal prolapse into the duodenum. Their present report is based upon three series of cases: a collected surgical group, a collected clinical group, and their own clinical group. Evaluation of the symptomatology from the data thus accumulated warrants the belief that prolapse of the gastric mucosa produces a more or less distinct clinical pattern and that the clinical and roentgen manifestations are adequate to sustain the diagnosis. The predominant symptoms are epigastric pain, gas, fullness, belching, burning, nausea, vomiting, bleeding, weakness, and loss of weight.

The roentgenographic findings as described in the paper cited above are repeated here, and the changeable appearance of the filling defect in different positions and exposures is re-emphasized.

Eight roentgenograms; 4 graphs; 1 drawing.

The Study of Function by Roentgenography after the Modified Hofmeister Resection. Magnus I. Smedal and William L. Conlon. S. Clin. North America **32:** 829–835, June 1952.

The purpose of this paper is to evaluate the immediate postoperative function, as determined roentgenologically, in 97 patients who underwent partial gastric resection at the New England Baptist Hospital and who were studied before being discharged. Fourteen of the patients had had previous surgery for their primary disease as follows: (1) repair of perforation of an ulcer, 4 cases (1 patient had two repairs of a perforation); (2) posterior gastroenterostomy, 9 cases, in 1 of which a vagotomy was done later, and (3) anterior gastroenterostomy, 1 case; this patient later required an entero-enterostomy.

Generally the cases were studied within fourteen days of resection. The following conditions were observed: *Obstruction*. Only 1 case was seen of complete obstruction at the stoma. This was attributed to edema, and it subsided under medical management. *Dumping Syndrome*. This type of reaction was not seen following the modified Hofmeister type of resection, although rapid emptying of the stomach occurred in 7 cases. It slowed down as more barium filled the stomach. *Residual Barium in the Proximal Anastomosing Loop* one hour after start of examination. A very slight amount of barium in the proximal loop was seen in 67 cases, a moderate amount in 24 cases, and a large amount in 5 cases.

The authors conclude that stasis in the proximal bowel is not significant; there is little tendency to "dumping" and better mixture of food with intestinal juices is accomplished with the modified Hofmeister type of resection.

Ten roentgenograms; 3 tables.

JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Some Observations on the Function of the Small Intestine After Gastrectomy. A. J. Glazebrook and Richard B. Welbourn. Brit. J. Surg. **40:** 111–117, September 1952.

After total gastrectomy and subtotal gastrectomy of the Polya type, food enters the small intestine almost at once without having been prepared by the stomach or duodenum, and its bulk or hypertonicity may give rise to a number of postgastrectomy syndromes.

The authors found that inflation of a balloon in the efferent jejunal loop of the anastomosis reproduced "dumping symptoms" in 3 out of 23 patients. Kymography showed simultaneous increased motor activity.

Hypertonic solutions introduced into the jejunum caused "dumping symptoms" in 9 cases and also produced evidence of marked activity on the kymograph, but dilatation of the jejunum was not demonstrable while symptoms were present. Injection of methonium salts caused a diminution of "dumping symptoms" and produced a marked reduction in jejunal activity.

Hypertonic barium meals produced "dumping symptoms" and marked activity in the jejunum in 5 cases. Methonium salts tended to reduce the peristaltic activity seen radiologically.

In post-gastrectomy steatorrhea, methonium salts had no effect in 4 mild cases but increased fat absorption in 2 cases of moderate severity.

Clinically, methonium salts were found to cause an increase in weight in 2 cases with moderate steatorrhea. They relieved post-prandial symptoms in 4 cases. In 8 further cases they either had no beneficial effect or produced unpleasant side-effects.

The authors conclude that the "dumping syndrome" is principally produced by increased motor activity in the jejunum, which provides the adequate stimulus for such symptoms as fullness, weakness, nausea, sweating, and palpitation.

Six roentgenograms; 3 kymographic tracings.

C. R. PERRYMAN, M.D.
Pittsburgh, Penna.

Intestinal Obstruction in the Newborn Infant Due to Agenesis of the Myenteric Plexus (Congenital Megacolon). Willis J. Potts, Joseph D. Boggs, and Harvey White. Pediatrics **10:** 253–264, September 1952.

Auerbach's myenteric plexus is a continuous plexus of nerve cells extending from the junction of the upper and middle thirds of the esophagus to the anus, lying between the inner circular and outer longitudinal muscle bundles and supplying nerve cells to both. Deficiencies in this plexus have long been associated with congenital megacolon.

The present report is based upon observations on 10 infants admitted to the hospital with symptoms of acute intestinal obstruction, who were proved to have functional obstruction due to agenesis of the myenteric plexus of various portions of the colon. The deficiency of cells is manifested by constriction at that point with proximal dilatation.

Microscopically, the cessation of ganglion cells occurs abruptly, over a distance of 2 or 3 cm., but the junction of the dilated and constricted portion is not necessarily correlated with the termination of ganglion cells. The surgeon cannot assume that ganglion cells are present above the constriction, and microscopic examination is the only way in which their presence can be definitely determined.

The wall of the colon may be three or four times the normal thickness. In 8 of 10 cases reported here the constriction occurred in the descending or sigmoid colon. Swenson (Pediatrics **8:** 542, 1951) has pointed out that in about one-half of the cases there is diminution of ganglion cells in the bladder near the ureteral orifices, with associated changes in the urinary tract—bladder atony, increased bladder capacity, and megaloureter.

Distention appears soon after birth, but the presence of shiny green-black meconium in the rectum, even in small amounts, is strongly indicative that the bowel is patent. If meconium has been passed, the diagnosis of atresia is probably not in order.

Radiographic study should include supine and erect films. The upright film will show fluid levels and the supine film will assist in locating the point of intestinal obstruction. Gas is seen in the descending colon and rectosigmoid. A barium enema is an aid not only in determining the location of gas but also in indicating the point of transition between dilated and normal appearing bowel.

If the child's condition warrants, the constricted segment should be resected, with anastomosis to bowel that is neurogenically normal as determined by biopsy. In poor-risk cases sigmoid-colostomy is the procedure of choice.

Three roentgenograms; 2 photomicrographs; 2 photographs showing the result of treatment.

MARSHALL B. TUCKER, M.D.
Oakland, Calif.

How the Radiologist Can Assist in the Management of the Long Intestinal Tube. R. A. MacPherson. J. Canad. A. Radiologists **3**: 54–56, September 1952. Also in Canad. M. A. J. **68**: 165–166, February 1953.

The author emphasizes that the use of the long intestinal tube for decompression in intestinal distention is a life-saving procedure which should be carried out with care and patience, with close co-operation between the radiologist and the attending physician. Passage of the long tube is contraindicated in cases of suspected strangulation and in obstruction due to external hernias, and is of limited value in large bowel obstruction.

The author describes the technic used in passage of the tube and states that the procedure may be done with or without fluoroscopy. The progress of decompression can best be determined by radiographic means; clinical evaluation may be misleading. Distention sometimes reappears proximal to the end of the tube, in which case the tube should be withdrawn to the jejunum and allowed to progress from this point. The optimum time to remove the tube is determined radiographically. Premature removal may cause return of the distention.

CARSON R. JONES, M.D.
Atlanta, Ga.

Surgical Treatment for Idiopathic Congenital Megacolon (Hirschsprung's Disease). David State. Surg., Gynec. & Obst. **95**: 201–212, August 1952.

A study of colonic function by means of fluoroscopic and roentgenographic examinations following a barium enema in patients with Hirschsprung's disease led the author to devise a new surgical approach to this condition, which has been successfully used in 16 patients.

The advantages claimed for this new procedure are the preservation of the rectum and the nervi erigentes plus the fact that resection of colon and the anastomosis are performed in the peritoneal cavity.

The roentgenographic findings, consisting chiefly of the demonstration of a narrowed segment of colon in the rectosigmoid region, as previously described by Neuhauser (Swenson, Neuhauser, and Pickett: J. Pediat **4**: 201, 1949. Abst. in Radiology **55**: 149, 1950) were confirmed in the author's patients, but, in addition, three other observations were made which have an important bearing upon his method of surgical approach. (1) The rectum appears to have a normal caliber. (2) The right side of the colon shows good haustral markings and evidences of normal contractility. (3) The left side of the colon, *i.e.*, the descending and sigmoid colon, are markedly dilated and show no evidences of haustral markings or peristaltic activity. These three points governed the extent of colonic resection in the author's cases.

The operation consists of removing the dilated portions of the colon which show no peristaltic activity roentgenographically, retaining the rectum, and performing an anastomosis between it and the right side of the transverse or ascending colon. The level of anastomosis is 6 to 10 cm. from the anal skin, and the anastomosis is extraperitonealized. The level of proximal transection was in the right half of the transverse colon in 14 cases; in 1 case it was in the ascending colon just proximal to the hepatic flexure, and in 1 case in the left side of the transverse colon. There were no deaths and no leaks at the line of anastomosis.

Following anesthesia and before operation, a urethral catheter is inserted, as many of these patients have idiopathic dilatation of the urinary bladder. A left paramedian incision is made, care being taken to keep the rectus muscle intact.

The author claims "excellent" results in 15 of the 16 patients operated upon. These patients now have daily bowel movements without enemas or cathartics. A result described as "good" was obtained in the remaining patient, who had postoperative abdominal distention and constipation but responded well to enemas. One year following operation this latter patient was having one to two spontaneous bowel movements daily, had grown 6 inches, and gained 22 pounds in weight.

The follow-up period for the patients ranged from six to thirty-six months. The age range was from two to twenty-one years. Representative case reports are presented.

Twelve roentgenograms; 1 drawing of the operative technic.

CHARLES E. EBY, M.D.
University of Pennsylvania

Observations on the Splenic Flexure Syndrome. Thomas E. Machella, Harvey J. Dworken, and Fructuoso J. Biel. Ann. Int. Med. **37**: 543–552, September 1952.

The authors have seen a number of patients complaining of chest pain and other manifestations simulating coronary artery disease but due to a non-coronary cause, namely, the "splenic flexure syndrome." Fluoroscopic examination of the abdomen in some of these patients during attacks of precordial pain revealed a collection of gas in the splenic flexure, suggesting that distention of this portion of the bowel by gas, or at times possibly by feces, might be responsible for the symptoms. Thus far, 19 male and 21 female patients with this syndrome have been observed. The average age was forty-six.

During an attack, pain or discomfort was experienced in more than one site in 80 per cent of the 40 cases. The discomfort occurred in the left upper quadrant of the abdomen in 75 per cent; in the left flank in 27.5 per cent; in the precordial area in 75 per cent; in one or both shoulders in 25 per cent; in the left side of the neck in 20 per cent; in one or both arms in 20 per cent; and in other sites (the left scapula, the interscapular area, both sides of the chest, the epigastrium, the xiphoid area, the jaw, and the ulnar side of the left hand) in 30 per cent. Symptoms other than pain included palpitation, shortness of breath, a sensation of choking, substernal oppression, and apprehension.

The factors or circumstances mentioned by the patient as precipitating the symptoms were: emotional disturbances, constipation, meals, and lying down. Relief from discomfort was attributed to the expulsion of feces or flatus, spontaneously or as the result of an enema, in 36 of the 40 cases.

The colon was examined by barium enema in 34 of

the 40 patients for the purpose of excluding organic disease. The examination was reported as "negative" in 19, as showing "spasm" or "irritability" of the sigmoid or other parts of the colon in 11, and as showing "increased tone" in one instance. Inspection of the available roentgen films in 32 cases revealed a very acute angle at the splenic flexure in 29 instances, an anatomic arrangement which could serve as a trap for gas or feces under appropriate circumstances. The splenic flexure is situated higher and more nearly posterior than the hepatic flexure. It may or may not rest against the diaphragm, depending upon the degree of its distention and upon that of the stomach.

The air inflation of a rubber balloon introduced into the splenic flexure by means of a tube containing a coiled spring reproduced the symptoms in each of the 9 patients in whom intubation was successfully accomplished. The amount of air required to reproduce the symptoms varied from 165 to 665 ml.

For distention of the splenic flexure to occur spontaneously, there should be, in addition to an obstructing element distally, a potent propulsive force proximal to the splenic flexure. This could be in the nature of increased motor activity or tonicity of the proximal colon and possibly the distal ileum Increased motor activity of both of these areas can be incited by emotional disturbances, as well as by the ingestion of meals.

The importance of proper recognition of the symptom complex lies in its differentiation from serious cardiac disease. The relief of symptoms by expulsion of flatus or feces furnishes a useful clue to the probable cause.

Three roentgenograms; 1 diagrammatic drawing; 3 tables. STEPHEN N. TAGER, M.D.
Evansville, Ind

Ameboma of the Transverse Colon. Harry Nushan and Benjamin Miller. Ann. Int. Med. **37:** 372–379, August 1952.

The authors state that the best procedure in making a diagnosis of amebiasis and its complications is first to be amebiasis conscious. This is well borne out by their case report.

A 54-year-old white male complained of weakness, anorexia and loss of 24 lb. in the previous year. He was a periodic drinker, his bouts lasting one to two weeks at a time. On examination, he appeared chronically ill. The red cell count was 3,800,000, white blood cells 5,500. Stools were positive for blood. A barium-enema study revealed a lesion in the transverse colon which was compatible with early carcinoma. At laparotomy, an area of reddening and thickening was found in this part of the colon measuring 8 cm. in length. A resection was followed by end-to-end anastomosis. The pathologist reported inflammatory change with invasion of the colon by *Endamoeba histolytica*, though smears from the rectum and warm stools were negative for amebae. Emetine, Diodoquin, and Carbarsone were given, and the patient had no further trouble from the colonic lesion.

Differentiation of ameboma (amebic granuloma) from carcinoma is extremely important, as the amebic lesion should be treated medically. The significant roentgen findings as described by Ochsner and DeBakey (Internat. Clin. **1:** 68, 1942) and Golden and Ducharme (Radiology **45:** 565, 1945) are listed as follows:

1. An amebic lesion may show multiple involvement, while a carcinomatous lesion is usually single.

2. Amebic obstruction of the colon is relatively incomplete, and the passage of barium through the colon causes comparatively little pain. On the other hand, in carcinoma of the colon there is a rigid wall with more complete obstruction of the lumen of the large bowel which, when filled, almost always causes pain.

3. In amebiasis, the colic and pericolic inflammatory process usually involves a rather large segment of the colon, while carcinoma involves only a relatively small area.

4. The transition from pathologic to normal intestine in ameboma occurs gradually, with no spur formation, whereas, in carcinoma, the change is abrupt.

5. Since the bowel wall in ameboma is not completely rigid, the lumen will appear wider on maximal filling of the bowel and narrower after evacuation of the enema. There is thus a change in the caliber of the bowel lumen on the immediate and the postevacuation films.

6. The mucosal pattern of the involved portion of the colon is more regular in amebiasis than it is in carcinoma.

7. Following antiamebic therapy, the lesion usually shows prompt regression and the colon is more or less normal in appearance.

This report is instructive, revealing the necessity for careful investigation when one is confronted by an atypical lesion in the colon. Amebic peritonitis or amebic infection of the skin and subcutaneous tissue may follow surgical removal of an ameboma. Fortunately, this unhappy complication did not ensue in the case recorded here.

Two roentgenograms; 1 photomicrograph.
PAUL W. ROMAN, M.D.
Baltimore, Md.

Incidental Diagnosis of Carcinoma of the Right Colon During Cholecystography. Samuel D. Hemley. Am. J. Digest. Dis. **19:** 295–298, September 1952.

The author notes that carcinoma of the right colon may be detected incidentally on a cholecystogram as a hiatus in the gas-filled bowel. The use of Priodax for cholecystography predisposes to gas formation in the colon, which serves as an aid to the diagnosis of a right colonic lesion as well as a hindrance to the visualization of the gallbladder. A case illustrating this finding is reported and several others are briefly mentioned.

Six roentgenograms. PAUL MASSIK, M.D.
Quincy, Mass.

Colovesical Fistula. Bentley P. Colcock. S. Clin. North America **32:** 909–911, June 1952.

Other than the rare fistula which is traumatic in origin, all colovesical fistulas follow either an inflammatory lesion affecting the pelvic viscera or a neoplastic lesion arising in this region. Of the inflammatory conditions which give rise to colovesical fistulas, diverticulitis of the sigmoid is by far the most common. The second most common cause is carcinoma of the sigmoid. The differentiation between these two conditions is of utmost clinical importance. The main reliance in distinguishing between carcinoma and diverticulitis must be upon the barium-enema examination. This may actually demonstrate the passage of barium from the colon into the bladder. More often, it reveals an obstructive lesion in this location. Di-

verticula may be seen but do not rule out a malignant neoplasm. The barium-enema study may show lipping above and below the obstructing lesion, typical of an ulcerating carcinoma.

Patients whose fistulas are the result of a malignant growth should have a radical resection of the rectosigmoid, sigmoid, and lower descending colon plus wide resection of the adjacent mesentery. Any involved bladder or small bowel must also be resected. Colovesical fistulas associated with diverticulitis can be safely and completely removed by a carefully planned three-stage operative procedure.

Two cases are presented.

Five roentgenograms. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Congenital Hernia of the Diaphragm with Special Reference to Right-Sided Hernia of the Liver and Intestines. Ernest E. Arnheim. Surg., Gynec. & Obst. **95**: 293–307, September 1952.

Three cases of congenital right-sided diaphragmatic hernia of the liver and intestines successfully treated surgically are reported. Nine other cases from the literature, in which the liver and intestine were the structures involved, are analyzed.

Congenital hernias result from failure of fusion of the various developing portions of the diaphragm or failure of muscular development in these regions. They occur much more frequently on the left side than on the right. The most common abdominal viscera involved are the small intestine and the ascending and proximal transverse colon. The displaced viscera in the thorax compress the homolateral lung, which is usually found as an airless mass of dark red tissue. The heart and mediastinal structures are displaced to the opposite side.

Clinically there are cyanosis, rapid respiration, and dyspnea. There may be dullness over the involved side of the chest or absence of breath sounds. Occasionally bowel sounds may be heard.

The diagnosis of right-sided diaphragmatic hernia was made by roentgen examination in 10 cases, including the author's (roentgenograms are not mentioned in the other 2 cases). The roentgen findings took the form of loops of intestine, filled with air or contrast medium, in the right side of the thorax. Displacement of the heart to the left side was commonly observed. The upward extension of the loops of intestine was limited in 3 of the 4 cases in which a sac was present. Pneumoperitoneum outlined the sac in 1 of the author's cases, but a differential diagnosis between hernia and eventration of the diaphragm was not made. The roentgenologic diagnosis of herniation of the liver into the thorax was made in this case. The author considers it surprising that involvement of the liver has not been diagnosed more frequently from the roentgenograms. The density of this organ in the right side of the thorax is, in itself, not characteristic, but when combined with loops of bowel in this region is of diagnostic value.

Prompt surgical treatment of congenital diaphragmatic hernia is extremely important in the newborn period. A technic for the plastic repair of almost complete absence of a hemidiaphragm, utilizing the hernial sac, is described.

Twenty-two roentgenograms; 5 drawings; 1 table.
M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

Tomography of the Gall-Bladder. Poul E. Andersen. Acta radiol **38**: 199–204, September 1952.

Three representative cases are presented to show how tomography often helps in visualization of non-opaque gallstones when bowel gas and feces or ribs and costal cartilages make routine free projection studies inconclusive. With careful centering and cuts from 3 to 8 cm., the technic may be used in any difficult case.

Ten roentgenograms.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Comparison of Cholecystography with Iodoalphionic Acid (Priodax) and a New Gallbladder Dye, Iodopropanoic Acid (Telepaque). Martin S. Abel, Irving I. Lomhoff, and Carlo V. Garcia. Permanente Found. M. Bull. **10**: 95–101, August 1952.

In a comparative study of 258 patients referred for gallbladder study, each receiving either Priodax or Telepaque, the following observations were made:

(1) Cholecystograms obtained with Telepaque were definitely better in opacity and diagnostic value than those with Priodax.

(2) The side reactions, though usually mild in both groups, were significantly fewer and of less severity with Telepaque, though 5 patients reported some dizziness, a symptom not noted by those receiving Priodax.

(3) In 15 of 20 patients whose gallbladders were not visualized with Priodax, re-examination with Telepaque gave fair to good visualization. In 12 of these a diagnosis of cholelithiasis was made and confirmed surgically. In 10 cases in which the gallbladder was not demonstrated by Telepaque, repeat studies with Priodax in double dosage also resulted in non-visualization.

Ten roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

The Significance of the Post-Fat Cholecystogram. Leo A. Harrington, Harold N. Schwinger, and Aaron Schwinger. Am. J. Digest. Dis. **19**: 284–286, September 1952.

In a study of 100 patients with no evidence of biliary tract disease in whom the gallbladder was visualized with Priodax, all but one showed some degree of contraction twenty-five and forty-five minutes after the administration of a fatty meal, leading the authors to conclude that the post-fat cholecystogram is of value. The degree of contraction varied markedly, but no comment is made as to the significance of the degree of contractility. The factors of race, sex, age, and weight are noted briefly.

One graph. PAUL MASSIE, M.D.
Quincy, Mass.

Utilization of Cholangiogram During Exploration for Biliary Atresia. Orvar Swenson and John H. Fisher. New England J. Med. **247**: 247–248, Aug. 14, 1952.

A method is presented by which patency of the biliary system in infants with increasing obstructive jaundice may be demonstrated by the instillation of a radiopaque medium into the gallbladder. This procedure is done at the operating table. The advantages are twofold: the small surgical procedure involves a minimal risk to the patient, and there is no chance of traumatizing the small ducts with this diagnostic

method. It is postulated that some of the cases, diagnosed as biliary atresia because of inability to demonstrate a patent extrahepatic biliary tree, fall into the group of mucoviscidosis.

The authors investigated 4 cases of neonatal obstructive jaundice in this manner. In 3, a patent biliary system was demonstrated by x-ray examination. In 1 patient no duct system was found.

Exploration with instillation of a blue dye originally, and later with a radiopaque medium, led the authors to the conclusion that in some patients small but patent ducts were present, and in these cases the obstruction was frequently due to inspissated bile. The jaundice was thought to be due to thick, tenacious biliary secretions inspissated in the bile ducts, causing mechanical obstruction. In one patient the viscosity of the fluid from duodenal drainage as measured in an Ostwald tube was seven minutes as compared with a normal reading of three minutes.

The gallbladder and liver are exposed by a right subcostal incision and a polyethylene catheter is inserted into the fundus of the gallbladder and tied in place with a purse-string suture. The biliary system is flushed out with a warm saline solution to wash out all particles of inspissated bile and to relax the sphincter of Oddi. The patient is then rotated to a right oblique position, and a portable x-ray unit is brought into position. Ten c.c. of warm 35 per cent Diodrast is instilled into the gallbladder, and the film is exposed as the last cubic centimeter is injected. If a patent biliary tree is demonstrated, no further surgery is necessary. If an anomaly of the duct system is visualized, surgical exploration with an attempt to relieve the obstruction is indicated.

One roentgenogram; 1 drawing.

ALFRED O. MILLER, M.D.
Louisville, Ky.

The "Reformed Gallbladder": Clinical and Roentgen Aspects. Raymond A. Gagliardi and Philip D. Gelbach. Am. J. Digest. Dis. **19**: 298–301, September 1952.

One of the causes of the so-called postcholecystectomy syndrome is the "reformed gallbladder." It has been demonstrated (Hartman, Smyth, and Wood: Ann. Surg. **75**: 203, 1922) that as little as 6 mm. of residual cystic duct following a cholecystectomy in animals will dilate. This happens in man also and symptoms due to inflammation or calculi may occur. The symptoms are similar to those of the preoperative period. They usually include typical colic associated with nausea and vomiting and residual soreness in the right upper abdominal quadrant. Jaundice may be encountered as a result of cholangitis or extrinsic pressure on the common duct. Calculi may be silent. They are less common in patients who did not have cholelithiasis at the time of operation.

Certain laboratory tests are of aid in making the correct diagnosis. The finding of calcium bilirubinate or cholesterol crystals by non-surgical duodenal drainage is usually indicative of calculi somewhere in the biliary tract. Hyperbilirubinemia occurring within twelve to twenty-four hours after an attack points toward calculi in the common duct or cystic duct remnant. X-ray demonstration of a calculus in the absence of a history of jaundice suggests calculus in the cystic duct remnant. This should be followed by intravenous pyelography to rule out renal calculi. This having been done, a cholecystogram should be obtained. Such a procedure offers two positive advantages: (1) it verifies (or disproves) the history of a previous cholecystectomy; (2) it may not only reveal a functioning cystic duct remnant but may also uncover the presence of non-opaque calculi.

An illustrative case is reported.

Four roentgenograms. PAUL MASSIK, M.D.
Quincy, Mass.

The Relationship of Biliary Tract Disorders to Diabetes Mellitus. J. Russell Twiss and R. Franklin Carter. Am. J. M. Sc. **224**: 263–273, September 1952.

Due to (1) the anatomic and physiologic relationship of the biliary tract and the pancreas and (2) the effect of functional and organic disease of the biliary tract upon the pancreas, the incidence of diabetes is increased by biliary tract disease.

Significant features of the anatomic arrangements are the path of the common bile duct through the head of the pancreas and the common opening of the pancreatic and common bile ducts above the sphincter of Oddi, which has been found to occur in 80 per cent of a large autopsy series. In patients with a common opening of the two ducts, obstructive lesions at the ampulla of Vater may lead to (1) biliary reflux of pancreatic secretion into the bile ducts and gallbladder, (2) pancreatic reflux of bile into the pancreatic ducts, (3) pancreatitis with possibly a subsequent diabetes.

Pathologic changes in the biliary tract which may precede or accompany diabetes are sphincter spasm, infectious cholecystitis, cholangitis, cholelithiasis, and benign or malignant neoplasms.

The authors report two cases. One illustrates chronic recurrent infectious cholecystitis and cholangitis, with stones and common duct obstruction, subsequent acute cholecystitis, cholangitis, and diabetes. The second patient had recurrent colic and jaundice due to chronic and persistent spasm of the common duct sphincter. Choledochoduodenostomy in this case was of apparently permanent value in improvement of the diabetic condition.

The authors state that diabetic patients with digestive symptoms should have the benefit of a comprehensive diagnostic investigation of the biliary tract and pancreas, including a cholecystogram. The early recognition and surgical correction of lesions may have an important prophylactic and therapeutic effect in diabetes.

Seven roentgenograms are reproduced. Six of these are cholangiograms with the pancreatic ducts visualized in 4 patients. The pathologic processes represented are acute cholecystitis associated with pancreatitis, common duct stone, and common duct sphincter spasm. The last roentgenogram shows the biliary tract filled during an upper gastrointestinal study after hepaticoduodenostomy. MARSHALL B. TUCKER, M.D.
Oakland, Calif.

THE MUSCULOSKELETAL SYSTEM

Roentgen Diagnosis of Bone Changes in Blood Diseases. Umberto Cocchi. Fortschr. a. d. Geb. d. Röntgenstrahlen **77**: 276–283, September 1952. (In German)

Although numerous blood dyscrasias produce radi-

ologically visible bone changes which in themselves are quite characteristic, truly pathognomonic findings are rare. The final diagnosis rests upon blood studies and biopsy. The direction of the investigation may, however, be influenced by the roentgen demonstration of osteoporosis, osteosclerosis, and circumscribed bone defects.

Thalassemia major, or *Cooley's anemia*, afflicts predominantly inhabitants of the Mediterranean littoral, as a recessively inherited disease. One finds splenomegaly, a peculiar yellow tint of the skin, and erythroblasts and target cells in the blood smear. Early in life the roentgenogram reveals a thinning of the calvarium from loss of the outer table. Later the perpendicular bone spicules of the "brush skull," or *Burstenschädel*, are seen. The long bones show generally increased radiolucency, a total increase in diameter of the diaphyses, but a diminished compacta. These so-called glassy bones rarely fracture.

Sickle-cell anemia, or *drepanocytosis*, a dominant hereditary ailment, occurs chiefly in the colored race, either in a latent or a manifest form. Afflicted children are apt to show hemolytic anemia, icterus, splenomegaly, abdominal colic, leg ulcers, and joint pains. The skull roentgenogram may disclose either osteoporosis or hyperostosis. The hyperostosis, unlike that in Cooley's anemia, tends to be diffuse, rarely in the form of a "brush skull." The expanded, glassy long bones are also seen. The frequent occurrence of thromboses and infarction in sickle-cell anemia is reflected in a high incidence of osteochondritis juvenilis, particularly of the hips. Bone infarcts, exactly like those of caisson disease and polycythemia vera, are common.

Familial hemolytic icterus, or *spherocytosis*, an hereditary disease of White Russians, yields the same bone changes as drepanocytosis and thalassemia major. In addition, the relationship of this disease to the hereditary affliction known as Gännslen's syndrome, may be detected in the frequency of *Turmschädel* and hypertelorism.

In *erythroblastosis foetalis* roentgenograms of the long bones may reveal a juxta-epiphyseal line of slightly increased bone density bordering a thin, transverse line of radiolucency in the diaphysis. The lines are best seen in the radius and ulna.

Polycythemia vera produces no generalized bone alteration of any consequence. In a manner similar to caisson disease, apparently the result of infarction, irregular zones of increased radiolucency occasionally develop in the distal femoral and proximal humeral metaphyses. On healing, threads of sclerosis are visible in these zones. One should note that polycythemia at times represents an early phase of osteomyelosclerosis—a disease with its own characteristic bone picture.

Hemophilia is manifest on the roentgenogram in the form of multiple joint changes. Early in life there is joint swelling, due to intra-articular hemorrhage, involving primarily the knees, elbows, and feet. Later in life one may find a narrowed joint space, marginal bone erosion, cyst formation, osteophyte production, subluxations, and ankylosis.

Multiple myeloma, the neoplastic overgrowth of myelogenous plasma cells, is commonly medullary in origin and only rarely extramedullary. According to Apitz the localized lesion is a plasmacytoma, while the diffuse form is better termed plasmacytosis. Electrophoretically four globulin types are recognized: alpha, beta 1, beta 2, and gamma; their importance is chiefly in prognosis, since the alpha type is the most malignant and the gamma the least so. Anatomically and radiographically three merging forms are known: the diffuse, the multiple osteolytic, and the focal. The diffuse form is that of osteoporosis, which involves most intensely the axial skeleton. Multiple osteolytic lesions involve, in addition to the axial skeleton, the ribs, humeri, and femora. Advanced cases with the soap-bubble bones, pathologic fractures and typical skull changes are characteristic, yet the bone lesions are not in themselves pathognomonic.

A form of rheumatism deserving mention in connection with skeletal changes is that due to *leukemia*. Masked under the diagnosis of Still's disease because of the swollen joints, fever, protracted clinical course, and severe pain, sleeps an occasional instance of leukemic arthritis. Actual diagnosis depends upon blood and bone marrow studies. Therapeutically one should note that there is no response to salicylates, but quick relief of pain with blood transfusion. The diagnosis of leukemia is never roentgenologic. The variable and confusing bone changes are at best suggestive. Moreover, medullary bone sclerosis has never been detected in an adult patient with leukemia. With such a finding either carcinomatosis or osteomyelosclerosis should be considered.

Six roentgenograms; 1 photograph.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Roentgenologic Diagnosis of Hyperparathyroidism. David G. Pugh. S. Clin. North America **32**: 1017–1030, August 1952.

Roentgen diagnosis of hyperparathyroidism can be made with assurance when definite disease of the bone is present. Only about one-third of the patients with this disease, however, show sufficient abnormality of bone to make roentgen diagnosis possible. Most cases are discovered during investigation of patients without skeletal disease but who have urinary calculi.

Since urinary excretion of calcium and phosphorus is increased in hyperparathyroidism and since an abnormally high serum calcium level is maintained, it is necessary that these minerals be available. If they are provided in the diet, the bones are protected and show no changes; the kidneys, however, may be severely damaged. If calcium and phosphorus must be removed from the bones, there is increased activity of osteoclasts and osteoblasts. Associated with this is an increase in alkaline phosphatase. In cases of hyperparathyroidism with an elevated alkaline phosphatase, bone changes are almost always present.

While generalized involvement of bone is of interest, it is not of great assistance to the physician in making a definite diagnosis of hyperparathyroidism in many cases. The changes that occur in the phalanges of the fingers are pathognomonic. These consist of a lace-like decalcification of the cortical bone just beneath the periosteum, referred to as a subperiosteal resorption of bone. While it is shown best in the middle phalanges, it is frequently accompanied by a resorption of the terminal tufts of the distal phalanges. With evidence of this sort the diagnosis of hyperparathyroidism can be made with great assurance, but it must be borne in mind that exactly the same changes are seen in the secondary hyperparathyroid disease associated with chronic renal insufficiency.

Another manifestation of subperiosteal resorption of bone is seen in dental roentgenograms, when there is absorption of the lamina dura, which represents the cortex of bone around the teeth. This sign is not as reliable as subperiosteal resorption of bone in the phalanges for it may be also seen in malacic conditions and in early Paget's disease. The lamina is not present in edentulous persons.

The skull will usually show a peculiar granular decalcification with blurring of the inner and outer tables in hyperparathyroidism. This finding is not as helpful as those in the hands and teeth. It may be produced by a secondary hyperparathyroidism.

In the differential diagnosis, one must consider renal osteodystrophy, which includes renal rickets in children. Renal insufficiency of long standing may induce bone changes that cannot be distinguished roentgenologically from those of primary hyperparathyroidism. Differentiation must be made if at all possible, since operation is mandatory in primary hyperparathyroidism but harmful in renal osteodystrophy. Renal rickets in children is easily recognized and, since primary hyperparathyroidism seldom occurs in children, diagnostic difficulties are usually limited to the adult. Cyst-like lesions in bone do not occur as frequently in secondary hyperparathyroidism as in the primary form. Extensive vascular calcification is frequent in renal osteodystrophy but rare in primary hyperparathyroidism.

Fibrous dysplasia of bone is a localized disturbance in growth and development, resulting in cyst-like lesions of varying distribution which superficially resemble those of hyperparathyroidism. "Osteitis fibrosa cystica" was formerly used to describe both conditions, and the author believes the term should be abandoned. The areas which suggest cysts in fibrous dysplasia show replacement of the spongiosa and marrow by fibrous tissue. The changes in the phalanges and lamina dura are never seen. Skull changes in no way resemble those in hyperparathyroidism.

Osteomalacia is a condition in which there is a normal laying down of osteoid but a defect in the calcification of the organic matrix. It can result from poor absorption of calcium from the gastrointestinal tract or resistance to the action of vitamin D. It may also be due to renal tubular disease with excessive excretion of calcium or phosphorus. Pseudofractures are common. The subperiosteal resorption in the phalanges is never seen.

Osteoporosis represents a deficiency in organic matrix of bone and usually results from a lack of osteoblast activity. Causes are hypogonadism, especially in the postmenopausal state, senility, immobilization, and protein insufficiency, such as occurs in Cushing's disease or starvation. Roentgenologically pseudofractures are never encountered. While there is apparent decalcification of bone, subperiosteal resorption is not seen and the granular decalcification of the calvarium, seen in hyperparathyroidism, is never found.

Thirteen roentgenograms.

JOHN F. RIESSER, M.D.
Springfield, Ohio

The Skeletal Changes in Leukemia. E. Uehlinger. Fortschr. a. d. Geb. d. Röntgenstrahlen **77**: 263–276, September 1952. (In German)

The commonly accepted statement of Markoff that hyperfunction of the red marrow leads to a decrease, and hypofunction of the red marrow to an increase in ossification can no longer be considered a working hypothesis. Depending upon the instance, one can observe changes in the bone in accordance with the condition of the marrow, changes in the marrow as the result of bone disease, and, as is the case in most leukemias, a more or less complete indifference on the part of the osseous tissue to what is going on in the marrow. Leukemic tissue, particularly in the adult, seldom alters the bone itself. Hematopoietic tissue is invasive but not destructive.

Though uncommon, such bone changes as do occur in leukemia may consist of either bone destruction or bone production. It is not the tumor cells themselves that vary the picture but their effect upon the osteoblasts and osteoclasts. The more usual finding of bone destruction is due to destruction of the osteoblasts with sparing of the osteoclasts. Productive changes arise in either the periosteum or the endosteum. In the former event, leukemic cells actually separate the periosteum from the tela ossea. With retention of the osteogenic properties, new bone is continuously formed which, because of the vascular relationships, patterns itself as the teeth of a comb. The leukemic skull is thus a "brush skull," like that of familial hemolytic icterus. In the rare endosteal hyperostosis, also called spongiosclerosis and medullary sclerosis, one can detect microscopically a layer of differentiated fibrous tissue interposed between the leukemic cells and the old bone trabeculae. These cells act as osteoblasts to lay down arcades of new bone.

Leukemic marrow infiltration is widespread so that, when visualized, the bone changes are general. The pattern is one of rapid alterations in appearance in accordance with the phenomenal growth potential of leukemic cells, and one of phasic remission and exacerbation. The axial skeleton is not favored as in carcinomatosis. No difference can be detected roentgenologically between lymphatic and myelogenous leukemia. Because of the time element only the chronic varieties are of any radiologic consequence. Studies of the age distribution in many series of cases reveals that the diagnosis may but infrequently be made in adults and, when made, one must note that senile osteoporosis is indistinguishable from leukemic deossification. The author diagnosed leukemic infiltration only 7 times in 89 cases. In children this statement is reversed. While Caffey's comment that all children with chronic leukemia eventually show bone alteration may not be entirely true, certainly it applies to more than half the patients.

Adult leukemia yields three varieties of bone change: diffuse osteoporosis, focal osteolysis, and focal bone destruction. Diffuse leukemic osteoporosis is characteristic only in that it may become extreme, with tremendous loss of bone density and elevation of the blood calcium above 17 mg. per cent. Focal osteolysis is scattered and widespread, with the individual foci the size of rice grains when first seen. With progression, increase in size is rapid, so that in many instances roentgen differentiation from multiple myeloma is impossible, although the individual lesions of the latter tend to be more sharply demarcated. Confusion is to be expected, since borderline cases, plasma-cell leukemias, occur. Solitary lesions of focal bone destruction are extremely rare. The author noted but one instance in a case of lymphatic leukemia.

The leukemic changes in children consist of: (1) juxta-epiphyseal osteoporosis, (2) generalized osteoporosis, (3) scattered osteolysis, (4) medullary scler-

osis, and (5) periosteal osteophytosis. Juxta-epiphyseal osteoporosis, a non-specific finding, is seen as a wavy band of increased radiolucency, a millimeter or more wide, on the immediate metaphyseal side of the epiphyseal plate. It requires at least six weeks to appear, is due to tumor infiltration of the primary osteoblastic tissue, and may disappear within three weeks in remission. Sites of predilection include the distal and proximal tibial metaphyses, the distal femoral and the distal and proximal radial, in order of decreasing frequency. The codfish vertebra of childhood and the granular atrophy of the outer table of the skull constitute the more widely known phases of generalized osteoporosis, but are also diagnostically non-specific.

The most common lesions are those of scattered osteolysis: the moth-eaten bones of leukemia. Both epiphyses and metaphyses, both long bones and small bones, flat bones and tubular bones reveal rapidly growing round and oval defects which first involve the spongiosa and then later destroy the compacta, so that in the well developed case the picture is almost pathognomonic. A remission in such patients results in condensation of the bone trabeculae along the pressure lines and yields the non-diagnostic x-ray findings of hypertrophic bone atrophy. Periosteal new bone may be detected in 40 per cent of leukemias of over six weeks duration as a pencil-fine line of ossification paralleling the length of the diaphysis, and separated from the original compacta by a clear space. In the skull the periosteum lays down the comb bone. Medullary sclerosis is a rarity. The author has seen only one case in which the osteosclerosis could be definitely ascribed to leukemia.

Eleven roentgenograms; 8 photomicrographs; 1 photograph.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Basis of the X-ray Findings in Osteomyelosclerosis. R. Stodtmeister and St. Sandkühler. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 283–287, September 1952. (In German)

In 1879 Heuck first described a triad of spongiosclerosis, spenomegaly, and hematopoietic insufficiency. This ailment, as the Heuck type, is now included along with the Vaughan type, the Baumgarten-Assmann type, and other similar obscure blood disorders, under the term osteomyelosclerosis. This term, while not necessarily indicating an entity *sui generis*, does indicate decrease or loss of hematopoiesis in the bone marrow with abnormal extramedullary hematopoiesis. With degeneration of the blood-forming elements in the bone marrow, osteosclerosis appears and is readily seen on roentgenograms of the long bones, of certain flat bones, and at times of the entire skeleton. The sclerosis is usually somewhat spotty, so that errors in interpretation are possible, since the intervening normal bone is radiolucent in contrast to the involved bone.

The cause of osteomyelosclerosis is unknown. Certainly the bone sclerosis is not basic, for the clinical course does not at all parallel the changes. Polycythemia vera is somehow related. In most patients with polycythemia who live long enough, a myelofibrosis develops which will progress to an osteomyelosclerosis. The enlarged spleen is apparently secondary, although as the source of the immature blood cells it contributes to the pattern.

Clinically the spleen is immensely important. In osteomyelosclerosis this organ is extraordinarily radiosensitive. Even the ordinary diagnostic x-ray studies produce a deleterious effect upon the peripheral blood picture as shown by the authors' graph of leukocyte counts in 6 cases. The authors also cite an instance of fatal leukopenia following splenectomy. In osteomyelosclerosis the use of splenectomy, cytotoxic drugs, and radiotherapy is apt to be catastrophic.

One roentgenogram; 3 photomicrographs; 1 graph.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

The Roentgenologic, Hematologic, and Pathologic Basis of Leuko-erythroblastic Anemia of the Vaughan Type. R. Birkner and J. G. Frey. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 287–297, September 1952. (In German)

Cases of osteosclerotic anemia tend to fall into three groups: anemia associated with Albers-Schönberg disease, osteomyelosclerosis of the Assmann-Heuck type, and osteomyelosclerosis of the Vaughan type. Vaughan's myelosclerosis represents characteristic changes in the peripheral blood and on sternal puncture and splenic puncture. Immature red blood cells and white blood cells are uniformly seen, rendering the term "leukemoid" appropriate. The anemia is relatively constant, although the earliest phase of this ailment apparently is polycythemia vera. Sternal puncture, which may be technically difficult because of the hardness of the bone, yields evidence of myelofibrosis with islands of myeloid metaplasia. Autopsy studies have revealed extramedullary hematopoiesis in the liver, spleen, ovaries, and adrenals.

The authors report 2 cases. The first case was that of a 67-year-old woman observed in the polycythemic phase. The second patient was a 53-year-old physician who succumbed one hour following an ill-conceived splenectomy. Both patients showed typical bone changes on the roentgenogram, consisting of irregular areas of osteosclerosis involving the metaphyseal spongiosa of the long bones. This constitutes sclerotic atrophy secondary to progressive myelofibrosis.

Seven roentgenograms; 5 photomicrographs; 1 photograph.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

The Roentgen Demonstration of the Hemophilic Joint as It Appears on 136 Radiographs of the Fonio Collection. Anton Fonio and Willy Bühler. Radiol. clin. **21:** 316–331, September 1952. (In German)

For several decades, Fonio has collected joint radiographs of all hemophilic kindreds of the cantons of Graubünden and Berne and of some others living elsewhere in Switzerland. Bühler has worked up 136 radiographs of this collection. Ninety-one of these are reproduced in this article.

Pathologists recognize 3 stages of joint involvement: (1) hemarthrosis, (2) the panarthritic stage, and (3) the regressive stage resulting in stiffening and shrinking of the capsule, loss of cartilage space, and ankylosis, which is usually non-osseous. Blood-containing cysts in the bone marrow of epiphysis and shaft are a frequent sequela. Some of these communicate with the joint space.

The roentgen findings are described in detail. The synovia appears unusually dense due to its hemosiderin content. Ragged contours of the articular cortex are produced by erosion. The earliest erosions appear

at the lateral aspects of the osseochondral junctions, undermining the articular cortex so that a marginal pseudo-prominence is created. The intercondyloid fossa may be widened by pressure exerted by the hematoma (pathognomonic if present). Cyst-like rarefactions are numerous and need not necessarily lie in the neighborhood of the cartilage space. Atrophy and narrowing of the cartilage space are common, but bony ankylosis is rare. Transverse bands of increased density are sometimes seen in the metaphyses.

The knee is most frequently involved, followed in order by the elbow, ankle, wrist, shoulder, and hip. In 13 of 15 completely studied cases there was multiple joint involvement, with 3 joints affected in 5 cases, 4 joints in 3 cases, and 2, 5, 6, 7, and 8 joints in 1 case each. The joint changes may make their first appearance as early as the first or second year of life, when the child is learning to walk. More frequently, however, they are seen at puberty.

GERHART S. SCHWARZ, M.D.
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Pseudofractures and Essential Hypochromic Anemia. L. Brat. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 204–208, August 1952. (In German)

Pseudofractures (in Germany usually called *loosersche Umbauzonen*) are ribbon-like bone defects occurring for the most part symmetrically and perpendicular to the surface of the bone, closely resembling fissure fractures. They occur in infants in connection with rickets and in women especially during the menopause. They were frequently found in Europe after World War I as a result of improper nutrition. For a long time, they were thought to be a proof of osteomalacia and were attributed to lack of vitamin D. However, because of their occurrence during the menopause, particularly in unmarried women, some ovarian dysfunction has been thought to be a contributing factor. These pseudofractures may cause some pain, but usually not as much as would be expected from a true fracture, and the disability is usually slight.

The author reports the case of an unmarried woman of fifty years who had been complaining for two years of pain in the legs. She had always been "anemic." Menstruation had been prolonged and the blood flow quite heavy. X-ray examination revealed pseudofractures in the pelvis, in the right femoral neck, and in the tibia just below the knee. The blood examination showed a marked hypochromic anemia. Treatment consisted in rest in bed, a blood transfusion, and continuous medication of iron and vitamin D. Within a few days, the pain disappeared. After four weeks, there was marked improvement of the pseudofractures; after six months they could no longer be seen, and the patient felt fine. A blood count showed marked improvement of the anemia. For four months there had been no menstrual period and, therefore, no longer any loss of blood.

The author thinks that the pseudofractures in this unmarried patient were caused by an ovarian dysfunction. He believes that proper endocrine function is necessary for the utilization of vitamins and that, in the presence of a dysfunction of the ovaries, an increased amount of vitamin D may be necessary to avoid the appearance of vitamin deficiency symptoms. He points to the fact that vitamin D and sexual hormones are chemically closely related, both being bodies of a steroid character. He further notes that joint pains and bone pains occur quite often in cases of hypochromic anemia and suggests that in these cases careful x-ray examinations be made for pseudofractures and to determine whether a combination of pseudofractures and hypochromic anemia may not be much more common than we have believed so far.

Six roentgenograms. WM. A. MARSHALL, M.D.
Chicago, Ill.

A Contribution to Our Knowledge of Acro-osteolysis. H. Wieland. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 193–198, August 1952. (In German)

Harnasch has used the term "acro-osteolysis" to describe a syndrome of bone changes which do not seem to fit into any known disease complex, and which have some characteristics that are just the opposite of acromegaly (Fortschr. a. d. Geb. d. Röntgenstrahlen **72:** 352, 1950. Abst. in Radiology **56:** 303, 1951). The roentgenological findings are symmetrical defects of all terminal phalanges of the fingers without reactive bone changes and without destruction of the fingernails; symmetrical destructive changes of the metatarsophalangeal joints of both great toes, with some periosteal reaction; defects without bone reactions in some other toes; almost complete disappearance of the alveolar processes of the upper and lower jaws; various degenerative, perhaps inflammatory, changes in the intervertebral disks, and a moderately severe scoliosis of the lower cervical and upper dorsal spine. Harnasch believes that, while in acromegaly the bone changes are caused by a hyperfunction of the eosinophilic cells of the hypophysis, the changes in acro-osteolysis are due to a hypofunction of these cells.

The author describes in detail a case which seems to belong in this group. The patient was a 38-year-old woman who, in spite of very moderate food intake, had gained rapidly in weight during the last year. The fingers had become heavier and painful, and the nails had become brittle and deformed. Similar changes occurred in the great toes. Occasional paresthesias were noticed in the tips of the fingers and in the nose. The patient felt tired and had little appetite, but was very thirsty. Both hands were broad, the fingers stubby, thickened, and slightly red. There were atrophic changes in the skin.

Roentgenologically the sella turcica appeared unusually small. The bones of the hands and feet showed a diminished calcium content throughout, and in some of the terminal phalanges an osteolytic process had left only a narrow stump. The dorsal spine showed a kyphosis with osteoarthritic changes. Other diseases causing destructive bone lesions were excluded.

The writer has studied the literature and found a number of cases in which similar osteolytic bone lesions occurred. The French authors particularly have described such cases, using the name "essential osteolysis." The pathological findings are those of a fatty degeneration of the bones, but the etiology is unknown. Leriche believes that osteolysis is an extreme example of osteoporosis. Most writers report that the changes are painless and that, in spite of the rather extensive bone processes, there is only slight functional disability. The sensibility may be slightly diminished, but some cases show no neurological disturbances. The blood examination shows a normal serum calcium. The phosphates are occasionally diminished. The Wassermann reaction is almost always negative.

The author is not too sure that the changes described

by Harnasch and those described by various French authors as "essential osteolysis" do represent a distinct disease entity. He believes that this question cannot be answered as long as the etiology is not definitely established.

Six roentgenograms; 3 photographs.

Wm. A. Marshall, M.D.
Chicago, Ill.

Congenital Syphilis and Scurvy as Causes of Painful Joints in Childhood. Dhirendra Nath Mukherjee. J. Indian M. A. **21:** 510–513, September 1952.

Four cases of painful joints in infancy, 1 due to congenital syphilis and 3 to infantile scurvy, are reported.

Scurvy is usually diagnosed by x-ray examination of the knees. In the early stage of the disease there is simple atrophy of the bones. In the shaft the trabeculae cannot be seen and the bones assume a ground-glass appearance. The cortex is reduced in thickness (pencil point thinness) and the epiphyseal ends are sharply outlined. An irregular and thickened white line which represents the zone of ill-calcified cartilage can be discerned at the metaphysis. The epiphyseal centers of ossification also have a ground-glass appearance and are surrounded by a white ring. If one finds a zone of rarefaction below the white line, the roentgenogram is diagnostic of scurvy. This zone of rarefaction is a linear break in the bone which runs under and parallel to the white line. Epiphyseal separation may take place along the white line with compression of the epiphysis along the shaft. Subperiosteal hemorrhages are not visible roentgenographically in active scurvy but in healing scurvy the elevation is visible and presents a striking picture. This roentgenographic appearance in scurvy resembles that in syphilis, but in the latter the subepiphyseal rarefaction reaches far into the shaft, while in scurvy a linear subepiphyseal break is seen. In congenital syphilis periosteal elevation tends to be parallel to the shaft, while in scurvy the hemorrhage and periosteal elevation are greatest at the ends of long bones.

Seven roentgenograms.

The Roentgenological Appearance of Bone Metastases Following Malignant Neurogenic Tumors (Sympathogoniomas) in Childhood. R. Seyss. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 219–224, August 1952. (In German)

Malignant neurogenic tumors in childhood may theoretically take their origin from any part of the nervous system, but the great majority arise from the immature cells of the adrenal medulla. These tumors, known chiefly as sympathogoniomas, occur during intra-uterine life or in early childhood, for the most part before the age of five. They are highly malignant and metastasize early, mainly invading the skeletal system. Only about 200 cases are reported in the literature. The prognosis is poor, though temporary improvement has been obtained with urethane, nitrogen mustard, and with x-ray therapy.

The author describes one case in detail and mentions another case in which, however, postmortem examination was not obtained. The first patient was a boy of four and one-half years, who complained of backaches. X-ray examination showed a diminution in height of the body of the seventh dorsal vertebra with some uneven appearance of the vertebral end plate. The rest of the skeleton showed nothing abnormal, and no definite diagnosis could be made. Four months later a complete change could be observed. Exophthalmos had developed, the liver was markedly enlarged, and there were several hard, immovable tumors on the skull. The x-ray examination revealed a diffuse osteoporosis of the skull, with numerous small bone defects with indistinct borders. The suture lines were wide open, the sella turcica was wide, the dorsum was missing. The long bones also showed numerous indistinct and in places confluent bone defects, particularly in the region of the metaphysis. About one month later, the disease had progressed rapidly. The body of the seventh dorsal vertebra was flattened out, the moth-eaten appearance of the bones had spread practically over the whole skeleton. In another month the patient died and a postmortem examination showed a tumor of the adrenal, the size of two fists. The pathological diagnosis was malignant ganglioneuroblastoma with multiple metastases within the skeleton, the para-aortic lymph nodes, and the musculature of the pelvis.

In the differential diagnosis, leukemia, Ewing's sarcoma, lymphogranuloma, lymphosarcoma, and myeloma must be considered.

Five roentgenograms. Wm. A. Marshall, M.D.
Chicago, Ill.

Osteoid Osteoma. K. F. MacEwen and M. R. Hall. J. Canad. A. Radiologists **3:** 48–53, September 1952.

A review of the literature yielded 158 proved cases of osteoid osteoma. The authors add 11 cases of their own. One hundred twelve of the total occurred between the ages of eleven and twenty-five. The site of the lesion is given for 163 cases: 71 involved the femur and tibia, while the vertebrae, astragalus, fingers, toes, and humerus were the next most frequent locations.

Pain is the most striking symptom. There may be localized tenderness to palpation.

The lesion is typically small, round or oval, with considerable reaction about it. The nidus is composed of a background of vascular fibrous stroma containing multinucleated giant cells and osteoid tissue. In early stages the tumor consists of a vascular mesenchymal substratum of osteoblasts and few osteoclasts. Later, an intercellular substance develops between the osteoblasts. This calcifies slowly and the tumor contains large amounts of osteoid or numerous osteoid trabeculae. The osteoid still later is converted into compact bone.

When the osteoid osteoma develops in spongy bone, it is surrounded by vascular tissue and this in turn by an area of sclerotic bony tissue. In compact bone the perifocal reaction is more marked. The cortex is thickened over a large area and is composed of two layers.

The radiologic picture closely follows the pathologic appearance. In early stages the lesion may be radiopaque, without a radiolucent ring. In the intermediate stage, the typical appearance is that of a circular radiolucent area, which may or may not contain a central nidus. In the final stage, the lesions resemble an osteoma; the nidus is very dense and is surrounded by a narrow radiolucent area.

The differential diagnosis should include a localized bone infection.

Three roentgenograms. I. R. Berger, M.D.
Atlanta, Ga.

Changes in the Lumbar Intervertebral Disks Without Clinical Symptoms. W. Rausch. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 199–203, August 1952. (In German)

It is generally assumed that most cases of sciatica are due to mechanical influences upon the nerve roots. The degree of anatomical change, as seen on the roentgen films, however, is no measure of the severity of the symptoms. More important for objective evaluation is the determination of the stability and mobility of the lumbar spine. The latter can be determined quite satisfactorily from films taken according to the technic of Knutsson (Acta radiol. **25:** 593, 1944. Abst. in Radiology **46:** 432, 1946) in true lateral direction in maximal flexion and maximal extension. The maximal flexion film is taken with the patient sitting and bending the body as far forward as possible. For the maximal extension film the patient stands, holding his arms backward and supporting his body on the back of a chair. Then, by superimposition of one film upon the other, the degree of motion can be ascertained. Abnormal sliding, which would indicate instability, can be recognized, and the degree and the extent of spontaneous immobilization can be seen.

The author has reviewed the films of 500 patients who have had x-ray examinations on account of stomach, bowel, or kidney disease. In 65 of these cases he found a definite narrowing of one or more lumbar disk spaces. In 53 of these patients the symptoms could be fully explained by the findings in the gastrointestinal tract or in the kidneys. These 53 patients were given a careful x-ray examination of the spine according to the method of Knutsson. Seventeen of these with one or more narrow disk spaces still had some mobility, although it was definitely decreased; 12 had a complete stiffening of the segments involved, and in 24 of the cases some of the segments had reduced mobility while others were entirely stiff. Some of the patients with limited mobility occasionally had attacks of pain and evidences of nerve root irritation, while those in whom immobilization was complete were entirely free from symptoms. The complete immobilization is accomplished by a total loss of elasticity of the disk and its replacement by fibrous tissue. This produces stability of the spine even without the formation of bony bridges along the margins of the vertebral bodies.

The author is convinced that an anatomical narrowing of the intervertebral foramen, due to a narrow disk, is not of itself sufficient to produce severe subjective findings. The factor of motion is much more important. Ordinarily, the nerve and its ganglion occupy only one-sixth to one-fourth of the opening through which they emerge. The rest of the space is filled with loose connective tissue and fat, forming an elastic cushion for the nerve. Under normal conditions, in some phases of movement of the lumbar spine, this space may diminish by about one third, but compression of the root will not occur because the loose tissue can give way. If, however, this spare space is occupied by prolapsed disk tissue, the root no longer has enough room to escape compression on motion. If motion is lost, the nerve will no longer be embarrassed. If there is a congenital synostosis of two vertebral bodies, the intervertebral foramen is considerably smaller than normal, but the nerve root is not compressed. In complete sacralization of the first lumbar vertebra, similarly, there is a markedly diminished intervertebral foramen, but without evidence of root compression.

The author believes that decompression of the root alone is not sufficient to produce a permanent cure in sciatica. Only an artificial fusion will remove the instability. Osteoarthritic spurs will then, by themselves, become resorbed and disappear, and the bony ring around the root may become wider. On the other hand, the fusion will also remove the symptoms that are due to reflex action from the irritated facet joints and the symptoms that are caused by fatigue of the muscle groups which must hold the involved segment of the spine for protection in muscular spasms.

Lindblom thinks that prolapsed disk tissue may gradually be resorbed. Besides, a prolapse may spontaneously give more room to the root by burying itself through pressure into the dorsal surface of the vertebral body and forming a bed there.

Two roentgenograms; 3 drawings.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Arthritic Changes in the Costovertebral Joints Following Thoracoplasty. Carlo Franchini. Radiol. med. (Milan) **38:** 837–843, September 1952. (In Italian)

The author studied 600 patients following thoracoplastic procedures and found that 20 per cent of these patients developed arthritic changes of the costovertebral joints due to the postoperative deformity of the thoracic cage. Most of the patients complained of pain in the area of the affected joints, usually from twelve to eighteen months after surgery.

Six roentgenograms; 2 drawings.

CESARE GIANTURCO, M.D.
Urbana, Ill.

THE SPINAL CORD

Intraspinal Tumors in Children Resembling Anterior Poliomyelitis. Report of Three Cases. William R. Chambers. J. Pediat. **41:** 288–293, September 1952.

Sudden paralysis, fever, stiff neck, and an increased cell count in the spinal fluid may occur in the presence of intraspinal tumors in childhood, as well as in anterior poliomyelitis. Three cases are presented by the author. In one a myelogram revealed an intraspinal space-occupying lesion. In the second a destructive process involving the sixth and seventh cervical vertebrae was shown roentgenologically. Destructive processes were also demonstrated in the third case. In this instance only—an angioma in the extradural space extending forward between the vertebral bodies—was the diagnosis established by biopsy.

The differentiation between anterior poliomyelitis and spinal cord tumor may be difficult. A spinal fluid protein of over 300 mg. per cent may be possible in poliomyelitis, but is not characteristic. Some temporary sensory changes may be present in poliomyelitis, but they are unusual. On the other hand, both of these findings are characteristic of intraspinal tumor.

Four roentgenograms; 1 photograph.

HOWARD L. STEINBACH, M.D.
University of California

GYNECOLOGY AND OBSTETRICS

Hysterosalpingography with Water-Soluble Contrast Media. W. Dietz. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 224–229, August 1952. (In German)

The great disadvantage of iodized oils for hystero-

salpingography lies in the danger of a granulomatous inflammation as a result of failure of absorption by the epithelial lining of the genital tract. Water-soluble media have the advantage that they are quickly absorbed and do not as a rule produce chronic granulomatous changes. The resorption may be so rapid, however, that a thorough investigation of every part of the genital tract cannot be made. Another disadvantage is the occurrence of local irritation and pain during the injection, believed to be due to the hypertonicity of the injected material, producing local edema. In order to overcome these handicaps, the author has been using water-soluble media of various degrees of viscosity. He has investigated Joduron, Perabrodil M viscous, Xumbradil (Astra), and another viscous material (Merck) not yet on the market. The first investigations were made with a rather thick medium having a viscosity of "3,000 cps." A relatively thin medium having a viscosity of "300 cps" was then tried. Finally, the author has been mixing several media to obtain a viscosity of "between 800 and 1,200 cps." This preparation has given the best results.

The very thick contrast media have the disadvantage that a great deal of pressure has to be used to force them through the tubes. On the other hand, they are less quickly absorbed than very thin preparations, which pass through the uterus and the tubes rather quickly. A large amount of the thinner media is necessary and, on account of their high hypertonicity, they are quite irritant and may produce pain.

The degree of contrast can be regulated by the time interval between the injection and the exposure, inasmuch as the material is gradually absorbed and diluted by the tissue fluids. The author reports as a particular advantage the ability of the water-soluble media to mix with tissue fluids within cavities. If there is a hydrosalpinx, for instance, the medium will mix with the fluid and the entire extent and shape of the hydrosalpinx can be demonstrated.

The author gives an intravenous sedative before undertaking the examination. The contrast medium is heated to about 40° Celsius and injected under fluoroscopic control (the fluoroscopy is restricted to a coned down small area and kept to a minimum of time). The first exposure is made about two to three minutes after the contrast medium has left the tubes and entered the peritoneal cavity. Additional exposures may be made ten to twenty minutes later. If at that time no passage of the medium through the tubes has occurred, they are assumed to be occluded.

The author believes that the same contraindications exist for the use of the water-soluble media as for hysterosalpingography with iodized oil.

Five roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Some Observations on the Shape and Course of the Female Urethra During Miction. Björn E. W. Nordenström. Acta radiol. **38:** 125–132, August 1952.

Although many anatomical studies of the female urethra have been made, few radiographic studies have been obtained during micturition. For such studies, use has previously been made of injected Lipiodol and of a light metal chain in the urethra. For his observations the author has used contrast material in the bladder and films in the anteroposterior and lateral projections in 10 continent and 50 incontinent patients. (For the technic see Nordenström: Acta radiol. **37:** 503, 1952. Abst. in Radiology **60:** 624, 1953.)

Several observations are mentioned as being new. (1) The middle portion of the urethra was visualized, appearing as a spool-shaped dilatation during micturition. (2) Distal to the dilatation was a constricted area about 1.0 cm. in length, apparently the narrowest portion of the urethra. (3) Distal to this constriction was a rounded dilatation similar to the navicular fossa in the male. (4) In the narrowed region described above the urethra in most instances changed its course, often quite abruptly.

Essentially the same observations were made upon injection of a plastic substance *via* the exposed bladder in cadavers, thus obtaining a cast of the urethra.

It is postulated that incontinence in women may be the result of straightening and loss of narrowing of the urethra, which thereby loses some of its natural resistance to the passage of urine.

The author discusses also the significance of the occurrence in the female urethra of a navicular fossa. He suggests that in both sexes it may be an anatomic detail caused by function.

Four illustrations.

GEORGE REGNIER, M.D.
University of Arkansas

Repeated Change in the Position of the Fetus Following Intrauterine Fetal Death. O. Wichtl. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 230–232, August 1952. (In German)

It has been generally assumed that a change in the position of the fetus no longer occurs in the event of fetal death. The author believes that this is not correct and that gravity plays a much greater part in the movements of the fetus than has been generally believed. He reports the case of a twenty-five-year-old nullipara, who was seen during the seventh or eight month of gestation with a history pointing to death of the fetus. The patient was observed in the clinic for a period of nine weeks. Fetal death was diagnosed on the basis of an abnormal curve of the spine, abnormal position of the extremities, and clinical absence of movements, heart sounds and fetal growth. During the nine weeks of observation, however, the fetus changed its position three times, as demonstrated on x-ray films: first from a breech presentation into a cephalic presentation, then back into a breech, and then again into a cephalic position. Finally, a badly macerated fetus was delivered spontaneously.

The only other observation of change in position of a dead fetus which the author could find was in a report by K. Abt (Radiol. clin. **20:** 50, 1951), who described two cases.

The author believes that normally the position of the fetus is to a great extent determined by active fetal movements, flexion and extension of the spine, etc. Eventually, the head is caught in the isthmus of the lower uterine segment, and the fetus is maintained in this position. In the case of a dead fetus, the relaxation of the uterus permits gravity to play a much greater role, thus making changes in position possible. That so few cases are described is attributed to the reluctance of obstetricians to make repeated x-ray examinations of a pregnant woman.

Four roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

GENITO-URINARY SYSTEM

See also The Blood Vessels

Renal Amino-Aciduria. Report of Two Cases, with Studies of Amino Acid Excretion Patterns. Harold A. Harper, Moses Grossman, Patricia Henderson, and Howard Steinbach. Am. J. Dis. Child. **84:** 327–339, September 1952.

The Fanconi syndrome is characterized by impaired renal tubular reabsorption of glucose, inorganic phosphate, and bicarbonate, as well as amino acids. Accompanying these kidney defects are acidosis and a negative calcium balance, with the development of renal rickets. Increased loss of glucose tends to produce depletion of hepatic glycogen, causing a ketosis which enhances the acidosis. This syndrome was originally described by Fanconi in 1946 as nephrotic glycosuric dwarfism with hypophosphatemic rickets.

The amino-aciduria is the prominent feature differentiating this condition from renal rickets or renal diabetes and the syndrome is related to two similar renal tubular defects in amino acid metabolism, namely, cystinuria and cystinosis. In cystinuria there is increased urinary excretion of cystine with increase in amounts of arginine and lysine as well. In cystinosis there is also serious systemic disease with deposition of cystine crystals in the tissues especially of the reticuloendothelial system, and the disease is usually fatal at an early age. The Fanconi syndrome is characterized by elevated excretion of all naturally occurring amino acids in the urine.

Two cases of generalized amino-aciduria were studied by the authors. Both patients were girls, aged five months and two years respectively. The first case terminated fatally, and at autopsy cystine storage disease (cystinosis) was found. All amino acids measured microbiologically in the urine were markedly elevated as compared to a control subject, but the amino acid pattern in both patients was essentially the same. As is the case in normal subjects, the amino acid pattern in the urine differed from that of the plasma, indicating that the generalized amino-aciduria was a manifestation of reduced capacity rather than total failure of reabsorption in the renal tubule. The biochemical diagnosis of the Fanconi syndrome can be made by finding urinary amino nitrogen which exceeds 3 per cent of the total nitrogen and by finding elevated urine levels of those amino acids which are normal in cystinuria.

Skeletal roentgen surveys in both cases revealed a generalized demineralization and coarsening of the trabeculae. The zone of provisional calcification at the ends of the long bones of the extremities was irregular or disappeared, and the metaphyses tended to show an irregular frayed appearance. There were marginal metaphyseal spurs. In the second case the changes in the skeleton were typical of those found in rickets.

Two roentgenograms; 4 tables.

JOHN F. RIESSER, M.D.
Springfield, Ohio

THE BLOOD VESSELS

Angiography for the Recognition, Treatment, and Evaluation of Peripheral Blood Vessel Disturbances. H. W. Pässler. Fortschr. a. d. Geb. d. Röntgenstrahlen Ergänzungsband 67, 1952, pp. 1–115.

This monograph deals with angiography of the peripheral blood vessels of the lower extremities and translumbar aortography. Cerebral and thoracic angiography are excluded. It is not a roentgen diagnostic book in the strictest sense, as it deals with the clinical relations of peripheral circulatory disturbances and the place of angiography is shown within the clinical frame. The importance of angiographic examination is stressed in every clinical connection.

The first 34 pages cover pathology, diagnosis, symptomatology, and technic of clinical examination of vascular disturbances, accompanied by numerous representative angiograms. The disturbances are divided into a functional group (Raynaud and related syndromes) and an organic group. The latter comprises (1) endangiitis obliterans (Buerger) and (2) sclerosis and atheromatosis of the arteries. Differentiation is often possible only by angiography.

Thirty-two pages are devoted to the technic of angiography under the headings arteriography, aortography, and venography, including indications for the procedures, its dangers, errors in technic and in film interpretation.

One section of 10 pages deals with the conservative and surgical treatment of the organic disturbances. The possibility of roentgen therapy is mentioned in a short inconclusive note.

The last section (30 pages) deals with the insurance and legal aspects of vascular diseases, showing the importance of angiographic control in the decisions. The list of literature contains sporadic American references.

Every section of the treatise reflects the rich experience and concise individual opinions of the well known German author.

One hundred and two figures illustrate the paper, for the most part characteristic roentgenograms, well reproduced.

LEWIS L. HAAS, M.D.
Chicago, Ill.

Abdominal Aortography. Torfinn Denstad. Acta radiol. **38:** 187–198, September 1952.

No complications were encountered in 97 cases of abdominal aortography by a translumbar approach with 30 c.c. of 70 per cent Perabrodil. A significant number of positive findings proved that the procedure was informative, and that it should be used more widely. Particularly important was the correlation of renal artery atrophy or hypertrophy to kidney function.

Demonstration of thrombosis, aneurysm, arteriosclerosis, and major vessel displacement by large masses were valuable findings. Aberrant renal arteries may be demonstrated, and their share of the kidney blood supply determined preoperatively. This may result in the choice of a resection rather than nephrectomy. Diseases which cause displacement of arteries in a particular organ furnish further indications for the procedure. Pathologic vessels in malignant tumors may be demonstrated, although a negative finding has no value in differential diagnosis.

Eleven roentgenograms.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Abdominal Aortography with Special Reference to Its Complications. Harry Larsson and Andreas Palmlöv. Acta radiol. **38:** 111–124, August 1952.

These authors made an experimental investigation

into the possible dangers of abdominal aortography, especially those which might be due to the effects of the contrast medium. These dangers are considered to be allergic reactions to the preparation used and toxic action upon the parenchymatous organs, particularly the liver and kidneys. The conclusion drawn is that the margin of safety in the concentration and quantities used by the authors (30 ml. of a 70 per cent solution of Umbradil or Dijodon) is large. The demonstration of the venous stage of the renal circulation is favored by increasing the amount of medium and by frequent exposures over a relative long period of time.

A survey of the complications and failure in 62 patients in whom aortography was attempted is also presented. In 7 of these the contrast medium was injected outside the aorta but there were no serious consequences. In 1 case, the right kidney apparently received the entire amount of Dijodon, as the injection was made very near the orifice of the right renal artery. The only unusual finding was a moderate decrease in the urea clearance. There were no other untoward effects in subsequent follow-up examinations.

Certain laboratory tests were performed in order to evaluate the possible toxic reactions. The daily output of urine showed no decrease. Urine concentration tests showed no change. A trace of albumin was found in a single instance. This cleared in three days. There was no change in the non-protein nitrogen. Microscopic studies of the urine revealed no change. In 8 cases urobilin determinations were made on the urine; all were negative, indicating that there was no liver damage.

Postmortem examinations were performed in 4 cases. There was no evidence of the aortic puncture site and no thrombi were found.

The chief difficulty encountered in the film interpretation was the superimposition of vascular shadows in cases where minor changes in the renal parenchyma were suspected.

Eight roentgenograms; 1 table.

J. B. SCRUGGS, M.D.
University of Arkansas

Prostatic and Periprostatic Phlebography. Benjamin S. Abeshouse and Malcolm E. Ruben. J. Urol. **68:** 640–646, September 1952.

The study reported here was done to simplify retropubic surgical removal of the prostate gland. Because of the paucity of literature with reference to the exact anatomic location of the veins surrounding the prostate and because there is a plethora of these veins, it was deemed necessary to locate them exactly prior to surgery. To this end a technic of prostatic or periprostatic phlebography was evolved.

A No. 20 needle, $1\frac{1}{2}$ inches long, is inserted percutaneously into the deep dorsal vein of the penis and is then connected with one limb of a three-way stopcock, another limb of which is connected to a bottle of intravenous saline solution and the third limb to a 20-c.c. syringe (Luer-Lok) containing 10 c.c. of 70 per cent Urokon. The saline solution is allowed to flow slowly into the vein until one is ready to inject the Urokon. The films are taken at 90–94 kv.p. and 200 ma., at 1/10–1/5 second, at a distance of 42 inches, using a cone angled 5 degrees toward the patient's head. Stereoscopic films are obtained, the first after 5 c.c. of the Urokon is injected and the second after the last 5 c.c. Injection is done rapidly, and the patient is advised to hold his breath and to strain as in defecating.

Reactions are few and consist of local heat and occasional respiratory oppression which lasts but a few seconds. Drugs to combat the last reaction are intravenous benadryl, adrenalin, coramine, and aminophyllin. Following the injection of the medium, the stopcock is switched to the saline solution, which is allowed to flow until the films have been developed. Should the films prove unsatisfactory, the study may be repeated.

Interpretation of the results entails a knowledge of the anatomy of the prostate gland along with the periprostatic and deep pelvic veins.

Anatomically, the deep dorsal vein of the penis empties into a liberal plexus of veins which communicate freely with one another and then delineate to form the lateral prostatic plexuses which empty into the internal iliac veins communicating with the obturator veins, the vesical plexus, and with the anterior rectal plexuses. Since, apparently, there are no valves in the deep pelvic veins, it is frequently possible to see the external iliac and upper femoral veins, as well as the lower inferior vena cava.

The technic described affords the opportunity of observing the pattern of veins around a normal prostate gland, those veins which might be encountered in prostatic surgery. Illustrations of the normal venous pattern, the pattern seen in benign prostatic hypertrophy, in prostatic cancer, and in thrombophlebitis of the upper femoral vein are shown. The authors suggest that this method might be useful in the diagnosis of the various occlusive diseases of the pelvic veins. It may also be used to demonstrate thrombosis of the dorsal or deep vein of the penis in cases of priapism. Its possible value in diagnosing all types of pelvic tumors, such as carcinoma of the sigmoid-rectum, carcinoma of the bladder, and retroperitoneal tumors of the lymphoma type, is also mentioned.

Four roentgenograms; 1 photograph.

THOMAS R. HEPLER, M.D.
University of Pennsylvania

Pelvioprostatic Venography: Preliminary Report. Raymond J. Fitzpatrick and Louis M. Orr. J. Urol. **68:** 647–651, September 1952.

The authors believe that the veins of the prostate and pelvis can be readily outlined by injection of a radiopaque material into the deep dorsal vein of the penis, which drains directly into the pudendal plexus. Information is obtained as to the size and character of the prostate by noting changes in the venous pattern.

A technic is described in which the vein is exposed under novocaine anesthesia and cannulated with a polyvinyl catheter before the patient is taken to the x-ray department. There a scout film is taken first. When for any reason a urethral catheter is already in place, the bulb of the Foley bag catheter is filled with Diodrast to mark the vesical neck. For the venogram 10 to 15 c.c. of 35 per cent Diodrast is injected as rapidly as possible and the exposure is made as the last 2 c.c. is being injected. With the use of the polyvinyl tubing, one need not worry about clot formation in the lumen, and thus several exposures can be made.

Five cases are reported in which this procedure was used without untoward reaction.

Five roentgenograms. PATRICIA F. BORNS, M.D.
University of Pennsylvania

Direct Surgery of Arteriosclerosis. Ormand C. Julian, William S. Dye, John H. Olwin, and Paul H. Jordan. Ann. Surg. **136:** 459–473, September 1952.

Although arteriosclerosis is a diffuse disease, locally obstructed segments of arteries can be removed or a channel through a diseased area may be opened. These procedures have been applied to the iliac and lower extremity arteries.

The clinical features in suitable candidates are lack of organic ischemic changes in the distal portion of the involved limb, while at the same time there is a high level pulse loss, indicating focal major arterial obstruction but with collaterals sufficient to prevent symptoms while resting. Final operative selection depends on arteriograms. The cases most suitable for operation show arteriographically an abrupt point of obstruction, the collaterals, and then distally the main channel again. Operation is less successful in cases in which numerous irregular filling defects are demonstrable proximal and distal to the obstruction and in those in which the distal portion of the main artery fails to fill. Surgery is not considered in patients with diffuse disease and a small but complete lumen.

Resection of 8 to 38 cm. of femoral arteries has been done with replacement by vein grafts, usually from the saphenous or superficial femoral vein. Intimectomy has been done to produce a good anastomosing site for grafts, to preclude in occasional situations the necessity of going proximal to the origin of a large collateral branch. Intimectomies have been done as the sole procedure five times on iliac arteries, once on the superficial femoral. To do this the cleavage plane between the elastic and sclerotic layers is found, the elastic layers are everted to form a cuff and then threaded back. Re-anastomosing the elastic layers follows.

Twelve of 19 vein grafts were successful, with return of ankle pulse and relief of intermittent claudication. Seven grafts failed. Of the 5 iliac intimectomies, 3 remained open, 2 re-occluded without benefit to the patients. The one superficial femoral artery intimectomy was successful in a three-month follow-up.

Sixteen arteriograms; 2 drawings; 3 tables.

LAWRENCE A. PILLA, M.D.
University of Louisville

Influence of Anticoagulant Administration on the Rate of Recanalization of Experimentally Thrombosed Veins. H. Payling Wright, M. M. Kubik, and M. Hayden. Brit. J. Surg. **40:** 163–166, September 1952.

To evaluate the effect of anticoagulants on the rate of recanalization of veins occluded by thrombi, the authors induced standard lengths of blood clot in rabbits. A group of the animals was then treated with Tromexan (bis-3-3′-(4-oxycoumarinyl) ethyl acetate), while the remainder served as controls. The progress of recanalization was followed by phelebography with 0.5 c.c. 50 per cent Diodone. The average time for recanalization in treated animals was 3.0 ± 0.21 weeks, while that for the controls was almost three times as long. Though the total numbers in each group were not large, the difference is statistically significant.

The authors suggest as a working hypothesis that the surface of a thrombus in contact with flowing blood may be supposed to undergo accretion through the continual deposition of fibrin film on its exposed surface. Any proteolytic action of the blood enzymes is, therefore, apparently without effect. Where the clotting mechanism is impaired, however, as after the administration of anticoagulants, no such deposition can take place, and the enzymic digestion of the fibrin network proceeds uninterruptedly. The action of the anticoagulant may, therefore, be an indirect one, which thus allows the recanalization of the vessel to take place in a shorter time than would occur under normal conditions.

Four roentgenograms; 2 photographs; 1 table.

TECHNIC; CONTRAST MEDIA

Value of the Flat Plate (X-Ray) in Diagnosis of Acute Abdominal Conditions. E. C. Paulson. Minnesota Med. **35:** 870–871, September 1952.

In studying the "flat plate," better termed the "scout film," of the abdomen a systematic routine should be followed so that no information may be missed. It is suggested that one study first the bony structures, looking for fractures, metastatic lesions, and anomalies. The soft-tissue shadows should next be observed, including the spleen, kidneys, psoas muscles, liver, bases of the lungs, and diaphragm. Following this, should come a search for calcification, and finally the nature of intestinal gas distribution should be observed.

It is believed that a scout film studied in this manner can contribute very pertinent diagnostic information when the salient clinical data are also available.

Experiences with High-Voltage Technic and an Ultra-Fine Focus X-Ray Tube. J. Bücker. Fortschr. a. d. Geb. d. Röntgenstrahlen **77:** 153–165, August 1952. (In German)

The author believes that a combination of high-voltage technic and the ultra-fine-focus x-ray tube has opened an entirely new field in gastrointestinal spot radiography. He uses a C.H.F. Mueller tube with a 0.3-mm. focal spot, 125 kv., 20 ma., and an exposure time of about a tenth of a second. The following advantages are mentioned:

The high kilovoltage permits a very short exposure.

A Bucky diaphragm or a grid is not necessary because the x-ray beam is coned down to a circle of only about 8 cm. diameter. Furthermore, due to the compression, the volume of the penetrated area is so reduced that there is not much secondary radiation.

Ordinarily, the barium-filled gastrointestinal organs appear much too "contrasty." For the delicate mucosal folds to be seen, they have to be compressed. With the ordinary technic, at about 75 kv., the compression must be quite heavy and the mucosal folds may thus be distorted. With high-voltage technic, much less compression is required. Furthermore, it is possible to visualize the folds along the anterior as well as along the posterior wall of the stomach. As the compression cones are mostly curved, the old low-voltage technic gives a good visualization of the mucosal folds only in the center, while along the periphery they are blotted out. With the high-voltage technic, even the periphery is penetrated, and the nature of the mucosal folds can be plainly seen up to the very edge of the film. Particularly striking is the difference in the sharpness of the folds with the old 1-mm. focal spot and the new ultra-fine focal spot.

The diagnosis of the hypertrophic form of gastritis is based upon a granular and nodular appearance of the mucosal folds. These changes can be plainly demonstrated by using an ultra-fine focal spot.

In the early mucosal changes of carcinoma of the stomach or of inflammatory hyperplastic changes in the small intestine, an ultra-fine focal spot with its pin-point-like sharpness is of inestimable value. Another advantage is that with the high-voltage technic a lesser amount of x-rays is applied to the skin of the patient and repeated examinations can be carried out with much less danger of x-ray damage.

The author presents numerous films of the mucous folds of the stomach taken with the high-voltage technic as well as with the conventional 75-kv. technic. He reproduces, also, roentgenograms taken with a 1-mm. focal spot and those of the same area taken with an 0.3-mm. focal spot. The films are quite convincing and show definitely that better detail, sharper outline, and a wider latitude of pathological changes can be demonstrated with 125 kv. and 0.3 mm. focal spot.

Thirty-one roentgenograms.

[The new Dynamax 40 x-ray tube (Machlett) allowing a maximal voltage rating of 125 kv. is now available with a 0.3 mm. focal spot. This tube will allow the same technic that the author has used. It will be interesting to know whether his experiences can be substantiated by American radiologists.—W.A.M.]

WM. A. MARSHALL, M.D.
Chicago, Ill.

A Compression Apparatus for Urography. Ragnar Steinert. Acta radiol. **38:** 212–214, September 1952.

The author has used two small separately controlled balloons strapped directly to the abdomen for ureteral compression during urography, thus permitting specific investigation of either ureter. This apparatus incorporates freedom of motion and less discomfort to the patient with higher pressures and selective utilization of the most desired pressure on either side, independently. It has been employed in a "fairly large" number of examinations with satisfactory results.

One photograph.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

A Photometer for Determination of Exposure Time in Radiography. E. Kaiser and E. de Fine Licht. Acta radiol **38:** 167–172, September 1952.

A new type of roentgen photometer, utilizing a photo-electric cell activated by light from a fluoroscopic screen is described. Following a test excitation, the device indicates by a pointer the required time necessary to obtain a suitable film density. Special types of equipment are used for fluoroscopy and radiography.

This photometer had been in use for six months at the Copenhagen County Hospital (Denmark) and the results are considered very satisfactory. The instrument has been found reliable for exposure times of 0.1 to 7 seconds and for voltages of 55 to 125 kv.

Application of the instrument to teaching fundamental principles of radiography as well as clinical utilization to obtain standard film density are discussed.

Three photographs; 1 diagram.

EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Microangiography. S. Bellman and A. Engström. Acta radiol. **38:** 98–110, August 1952.

A review of the theoretical aspects of microangiography is presented. The mass absorption coefficients for certain elements of interest in this procedure are shown in graphic form, as is also the transmission of roentgen rays in various thicknesses of soft tissues ranging between 50 and 500 micra. It is shown that if high absorption is required from the tissues, soft and ultrasoft roentgen rays must be used. The harder the rays, the stronger the scattering and other phenomena which may spoil the quality of the image.

The sharpness of the microradiographic image depends upon the following factors: (1) the size of the focal spot; (2) the distance between the focal spot, the sample, and the photographic emulsion; (3) movement of the sample; (4) the thickness and the granularity of the photographic emulsion; (5) the secondary characteristic radiation from the contrast medium employed in blood vessels; (6) the range and distribution of photo-electrons emitted on the passage of the roentgen rays through the sample and the emulsion itself.

In the experiments described by the author, a North American Philips roentgen diffraction unit with molybdenum or copper targets and a tube current of 14–16 ma. were employed. The effective wave length was calculated by measuring the absorption of the heterogeneous roentgen beam in different materials. From the measurements, the effective wave length was calculated to be 1.3 Å. for 25-kv. radiation from the copper tube and 1.2 Å. from the molybdenum tube. For higher voltages (40–45 kv. on the primary scale) only slightly different values were obtained. This may be due to a decrease in sensitivity of the photographic emulsion for decreasing wave lengths of the roentgen rays.

The focus-to-emulsion distance was 24 cm. The samples were mounted on thin mica sheets (20 to 40 micra in thickness) which were pressed against the photographic emulsion. The sample-plate could be tilted and the vertical axis of rotation lay in the emulsion plane. It was possible to register stereoscopic microradiograms. Kodak Maximum Resolution plates or Eastman Kodak Spectroscopic plates 548 or 649 were used.

The microradiograms were enlarged ×8 to ×20 by photomicrography and viewed in a "stereolup" (or magnifying stereoscope) with 4 times magnification.

Neoprotosil (Parke, Davis & Company) solutions were used as the contrast material in accordance with Barclay's recommendation. This contains 18 to 22 per cent silver iodide and 80 per cent protein. Solutions containing 50 per cent of contrast medium (weight/volume) can be injected into the capillaries. Such a solution contains 10 per cent silver iodide.

The medium was injected intra-arterially into surgical specimens and into heparinized and slain animals. The injection was continued until most of the blood was emptied through the opened veins. Tissue samples were removed from living animals in narcosis or after sacrificing the animals. The tissues were microradiographed in the wet state or after routine histologic preparation. Sections 0.1 to 2 mm. thick were cut.

The authors reproduce stereo-microradiograms from a 0.5 mm. section of a dog's kidney injected with 50 per cent Neoprotosil, as well as a section of bone in which the distribution of haversian canals is demonstrated.

It would seem possible to study the physiologic status of the capillary circulation by using such contrast media as Thorotrast and obtaining specimens from living animals by biopsy. The conclusion is presented that microangiography (author's term) appears to be a useful

method for studying the capillary circulation in tissues under normal and pathologic conditions.

Sixteen illustrations.

I. MESCHAN, M.D.
University of Arkansas

The Use of Thorium Dioxide Sol (Thorotrast) in the Roentgenologic Demonstration of Accessory Spleens. Virgil Loeb. Jr., William B. Seaman, and Carl V. Moore. Blood **7:** 904–914, September 1952.

The removal of accessory spleens has occasionally resulted in clinical remission when manifestations of idiopathic thrombocytopenic purpura or hereditary spherocytosis have failed to be relieved or have recurred after splenectomy. To justify such a procedure, however, the localization of the accessory organs should be established prior to surgery. The present report emphasizes the value of Thorotrast for this purpose.

Accessory spleens were demonstrated in 2 of 9 patients in whom there were hematologic and clinical relapses following splenectomy. In 1 of these, with acquired hemolytic anemia, a remission followed removal of the accessory spleen. The other, with a relapse seven years after splenectomy for hereditary spherocytosis, refused operation. In 7 patients with idiopathic thrombocytopenic purpura, no accessory spleens were demonstrable.

The authors quote the opinions of others as to the hazards of Thorotrast. Its carcinogenicity in man has been questioned, though animal experiments suggest a possible danger. In addition, late fibrosis and scar formation, which may occur either in the liver or spleen or at the site of injection, tends to contraindicate the use of this agent except in cases of extreme urgency.

Five roentgenograms, 1 photograph.

I. R. BERGER, M.D.
Atlanta, Ga.

ROENTGEN AND RADIUM THERAPY

Teleradium Treatment of Laryngeal Carcinoma at Radiumhemmet, Stockholm. Folke Jacobsson. Acta radiol. **38:** 143–163, August 1952.

The author first asserts that there is more or less agreement that those cases of laryngeal carcinoma which can be operated on by laryngofissure and excision of the tumor are also suitable for fractional irradiation and that the results appear to be the same with both methods. Opinions differ with regard to the efficacy of more radical procedures.

By definition the author includes as laryngeal carcinoma only those growths which lie or arise in the larynx below the level of the laryngeal inlet. There are four different groups, ranging from cases limited to one vocal cord without extension to the anterior commissure or posteriorly to the vocal process (Group I) to widespread unilateral or bilateral cancer of the larynx (Group IV). One hundred and seventy-eight cases of cancer of the larynx which were treated between 1935 and 1945 are reviewed. The main portion of the cases belong to Group IV (60 per cent), with 22 per cent in Group III, 7 per cent in Group II, and 11 per cent in Group I.

It is felt that the relatively high incidence of cancer of the larynx in females in Sweden, as compared with other countries of the world, is related to the high incidence of Plummer-Vinson's disease in Sweden. About 88 per cent of the author's patients were males, whereas in most other series the figure is 90 to 99 per cent.

It is probable that regular smoking may be considered a predisposing factor. In the present series, irritation by soot or dust, chemically irritating fumes, or vocal strain seemed to play some part, in that 75 per cent of the patients gave one or more of these factors in the occupational history.

In 52 per cent of the cases, the patients stated that they had suffered from symptoms for half a year or longer before consulting a physician.

It was difficult to determine the site of origin of the tumor in nearly half of the series. Most of the other cases arose in the vocal cord. In general, the further from the glottis and nearer the piriform sinus the tumor is situated, the earlier and more readily will metastasis to adjoining lymph nodes occur. In pure cancers of the vocal cords, metastases in lymph nodes in the vicinity have been extremely rare and did not occur in the present series. The frequency of metastases varies, depending upon the proportion of cancer of the vestibulum of the subglottis. In the series at hand, there were lymph node metastases in 20 per cent of the cases and in approximately a fifth of these there were distant metastases as well.

All the tumors in the series were squamous-cell carcinoma.

The author reviews briefly various methods of treatment. At the Radiumhemmet, teleradium irradiation is employed. This is done with an apparatus containing 5 gm. of radium, as described by Sievert (Acta radiol. **14:** 197, 1933), filtration equivalent to 6 mm. of lead, and a treatment distance between the radium and the skin of 6 cm. Circular fields having a diameter of 5 cm. are used, one on each side of the larynx and one anteriorly. Where there are metastases in adjoining lymph nodes, the number of fields may be increased to four or five. The distance between the centers of two adjacent fields is 6 to 6.5 cm. One field is treated daily, receiving a skin dose of about 1,000 r. Treatment is given over a period of twelve to nineteen days, and the tumor dose has generally been between 6,000 and 6,500 gamma roentgens. In recent years, the skin dose has been limited to 4,500 r, although in prior years as high as 5,000 r on either side were employed. The anterior field dose has varied between 4,000 and 4,500 r. With this treatment, even after many years the skin remains soft and supple. A moderate degree of telangiectasis can be seen as a permanent change.

Two months after the beginning of treatment, many of the purely teleradium-treated patients have been apparently cured and have been able to take up their normal work again.

Teleradium therapy following laryngectomy is generally given through two fields on each side of the neck, each area receiving a total skin dose of between 3,000 and 4,000 gamma roentgens. In most cases of metastases in the lymph-nodes, the primary tumor and/or the metastases have been inoperable and for that reason have also been irradiated.

In 106 of the author's cases, the tumor was primarily treated by radiotherapy, while in 72 cases the patient received postoperative irradiation. For the entire series a five-year "cure" of 51 per cent was obtained. If deaths

from intercurrent disease before the end of the five-year period, without symptoms of laryngeal carcinoma, are deducted, a net five-year "cure" of 57 per cent is obtained. For 106 cases irradiated only (no surgery employed) the five-year "cure" rate was 40 per cent (about 44 per cent, if allowance is made for intercurrent death from unrelated diseases). In those cases treated by primary laryngectomy and postoperative radiotherapy (62 cases), the five-year survival was 64 per cent. Three additional patients remained free of symptoms but died within the five-year period from intercurrent disease.

In 46 cases, the tumor was so widespread that the only possible surgical procedure would have been laryngectomy. In 18 of these, a five-year "cure" was obtained exclusively by irradiation. In 4 additional cases, secondary laryngectomy was required after the five-year survival period, due to recurrence of tumor. Ten patients died from reactions or from intercurrent disease, and sections of the involved area showed no sign of any growth.

In 32 cases that were treated by irradiation only, the vocal cord was entirely fixed. In 25 of these the tumor had grown through the larynx and had infiltrated the surrounding tissues. A five-year survival was obtained in 5 of these cases, and 4 additional patients died within the interim from intercurrent disease.

Despite the fact that, in some series, it would seem that invasion of the arytenoid region is an indication of a very poor prognosis, all 3 of the author's patients that fell in this category survived five years or longer. Cancer of the subglottic region is also indicative of a very poor prognosis and an indication for surgery whenever possible. The breakdown into sites of origin in an effort to correlate with prognosis in this particular series is not too satisfactory, since the numbers of cases are so small. In general, lymph-node metastases make prognosis poor. In the present material, lymph nodes were involved in 37 cases; 8 of these were operated upon and irradiated postoperatively. Three five-year "cures" were obtained. The other cases were treated by radiotherapy only, with 2 five-year survivals.

In general, the prognosis in highly differentiated squamous-cell carcinoma is better than in the less differentiated types. The latter are usually advanced and have metastasized to a considerably greater extent by the time they come to treatment.

Radiotherapy did not seem to aggravate a later operation in those few cases that required it, nor was the risk of necrosis after such surgery enhanced. Perichondritis is the most important and difficult complication in the treatment of carcinoma of the larynx. In the present series, it was encountered in only 7 cases, or 6 per cent. This low incidence may be related to the fact that a gamma radiation was employed.

The author feels that test radiotherapy is permissible in poor operative risks, but this should be clearly explained to the patient. I. MESCHAN, M.D.
University of Arkansas

Carcinoma of the Larynx with Distant Lymphatic Metastases. Sidney Rubenfeld and Gustave Kaplan. Arch. Otolaryng. **56:** 255–261, September 1952.

The literature is conspicuously free of reports of distant spread of laryngeal tumors. The authors present 2 cases of carcinoma of the larynx in which distant spread occurred to the axillary nodes in one instance and along the lymphatics to the chest wall in the other.

In the first case, following a left radical neck dissection, the primary laryngeal cancer was treated with roentgen rays, 5,000 r over a period of thirty-one days (220 kv., a Thoraeus filter, 50 cm. distance) through two opposing portals of 8 cm. diameter. Three weeks later a biopsy taken through a laryngoscope showed no active tumor. Five months later a right radical neck dissection was performed because of the presence of nodes. About seventeen months after the x-ray therapy, several subcutaneous nodules appeared on both sides of the neck, as well as a large nodular fixed mass in the left axilla. An attempt was made to treat the lesion through a grid, but when no response was elicited with a dose of 6,000 r (air), it was abandoned.

In the second case, following a complete laryngectomy, x-ray therapy was administered for a tumor dose of 4,500 r over thirty-one days (2 mm. Cu half-value layer) but failed to induce any regression. A chain of subcutaneous nodules appeared along the left side of the chest. When respiratory difficulty developed, examination of the trachea disclosed infiltration as far down as the carina. This area was irradiated (3,400 r in forty days, 2 mm. Cu half-value layer). The patient obtained minimal benefit and eventually succumbed as a result of acute respiratory obstruction.

One roentgenogram; 4 photomicrographs; 4 photographs.

Radiotherapy of Cancer of the Esophagus. Rosmarie Benthaus. Strahlentherapie **88:** 640–646, 1952. (In German)

According to various statistics only 15 to 50 per cent of diagnosed cases of esophageal cancer have been found to be operable. The primary surgical mortality has ranged from 20 to 31 per cent. Surgeons report five-year survivals up to 8.6 per cent and three-year survivals of over 13 per cent. Rotational therapy by Nielsen *et al.* resulted in a survival of 3 per cent after four years and 1.5 per cent after five years (Acta radiol. **26:** 361, 1945. Abst. in Radiology **47:** 100, 1946). However, the results are not comparable, since the surgeons select the most favorable cases, while the great majority of the irradiated cases are inoperable, in advanced stages.

The present report covers 163 cases irradiated between 1929 and 1947. The final course could be observed in only 100 cases. Relatively low doses of conventional x-ray and radium radiation were administered, not exceeding 3,000 r tumor dose. The average survival time was six months, conforming to reports of other authors. As the average survival of untreated patients was five to six months, radiation in general did not prolong life. Five patients, however, survived one year, and 3 two years. In one patient a small, 406 r calculated tumor dose produced a temporary asymptomatic condition.

One table. LEWIS L. HAAS, M.D.
Chicago, Ill.

Results of Treatment and Other Statistical Data on Female Genital Carcinomas in the Second University Clinic of Gynecology in Munich between 1933 and 1944. S. v. Bary and J. Schuck. Strahlentherapie **88:** 597–618, 1952. (In German)

In the twelve years 1933–44, there were observed in the authors' clinic 1,094 cases of carcinoma of the female genital tract, 74.9 per cent of which were localized to

the cervix uteri, 9.8 per cent to the corpus, 11.1 per cent to the ovaries, and 4.2 per cent to the vagina, vulva, and tubes. A certain degree of heredity may be assumed, as 17 per cent of the patients reported carcinoma in their families.

Valuable time was frequently lost from the first symptoms to initiation of treatment. The average interval was 5.1 months between the first symptom and first medical consultation, and 1.9 months from consultation to clinic admission. Of the cervix cases, 68.4 per cent were operable (Stage I and II) at the time of admission.

Of 810 treated *cervix cases*, 785 received irradiation, 22 surgery plus irradiation, and 3 cases surgery only. The irradiation consisted of radium application followed by external roentgen irradiation. Of the 785 patients, 40 per cent survived five years: of the operable cases 51.5 per cent, of the inoperable cases 14.3 per cent. In cases in which the roentgen treatment was performed in other institutions and only radium was adminstered by the authors, the survival was only 20.1 per cent, proving that carcinoma treatment should be performed only in specialized departments. The mortality was 2.9 per cent, relatively high because the very advanced cases were also subjected to irradiation. Death was due to peritonitis, circulatory disturbances, or tumor cachexia. Complications of irradiation were proctitis, cystitis, fever, vomiting, and radiation sickness.

In *corpus carcinoma* (105 cases) the five-year survival was 87.4 per cent with surgery plus irradiation, and 31.9 per cent in cases receiving irradiation only.

In *ovarian carcinoma* (112 cases) the results were better after surgery plus irradiation (23.6 per cent) than after irradiation alone (6.2 per cent).

Of 27 *vaginal* cases 7 (25.9 per cent) were cured by radiation alone. Of 17 patients with *vulvar* cancer, only 1 survived five years.

Two graphs; 18 tables. LEWIS L. HAAS, M.D.
Chicago, Ill.

The Prognostic Value of Histologic Grading of Carcinoma of the Cervix Uteri. A Study of 388 Cases Treated with Radium and Roentgen Therapy. F. Linell and B. Månsson. Acta radiol. **38:** 219–238, September 1952.

Following presentation of a rather comprehensive review of the literature regarding histologic grading of carcinoma of the cervix uteri and its prognosis, the authors discuss their observations in a series of 309 completely treated cases, of which 291 were squamous-cell cancers and 18 adenocarcinomas. They used a method of histologic grading similar to that described by Ackerman and Regato, with three grades from well differentiated to distinct anaplasia. The sections were further graded in detail with regard to the amount of stroma, cellular reaction of the stroma, and the type of cells in the stromal reaction. All specimens were obtained and processed as routine examinations, although the grading was done by one individual.

Classification of the 291 squamous-cell carcinoma cases according to the League of Nations recommendation for local spread revealed a "five-year cure" of 42.6 per cent of all cases or 55, 46.3, 36.7, and 21.1 for each stage, respectively. Among the 18 cases of adenocarcinoma, there were 7 (39 per cent) "five-year cures." Radium and roentgen therapy were used in all cases.

The histologic grades were equally distributed throughout the clinical stages, with no significant difference in the frequency of "five-year cures" from one histologic group to another.

The other factors graded were statistically analyzed, and the following observations were made:

1. The amount of tumor mitosis does not seem to have prognostic significance.
2. The relative quantity of stroma was of no prognostic value.
3. The degree of cellular stromal reaction proved of no value in prognosis.

It was concluded that the simple grading of tumors on the basis of diagnostic biopsy specimens is of no prognostic value in cases to be treated with radiation. This agrees with the findings of earlier workers.

Eleven photomicrographs; 1 graph; 9 tables.
EDWARD E. TENNANT, M.D.
Jacksonville, N. C.

Primary Carcinoma of the Vagina. Olaf T. Messelt. Surg., Gynec. & Obst. **95:** 51–58, July 1952.

The author reviews 78 cases of primary vaginal carcinoma seen at The Norwegian Radium Hospital between 1932 and 1945. These represented 2.7 per cent of all admissions for female genital carcinoma. Most were squamous-cell tumors. A few were adenocarcinoma. Married women in the fifty-to-sixty-five-year group predominated. There was no association with the use of a pessary or the presence of uterine prolapse.

The main symptom was bleeding, either alone or with pain, discharge, itching, or a feeling of pressure. More than one-half of the patients had had symptoms for less than three months when they were first seen. The posterior wall of the vagina was the most frequent site of the tumor. Lesions of the upper one-third metastasized to the nodes along the external iliac and hypogastric vessels and to the region of the promontory of the symphysis pubis. Those of the lower one-third went to the inguinal, sacral, and common iliac nodes. In the middle third, metastasis was in either direction.

Therapy was primarily with various methods of radium application. A few cases were treated surgically. The overall five-year survival rate was 22.7 per cent. In those cases in which the tumors were limited to the vagina, the rate was 33 per cent. When there was extension outside of the vagina, the five-year survival rate was 11 per cent.

Two graphs; 6 tables. W. W. NAGLE, M.D.
University of Pennsylvania

Irradiation Treatment of Hearing Loss in Children. Merrill W. Michels and Irving I. Lomhoff. Permanente Found. M. Bull. **10:** 102–108, August 1952.

In the years 1948–51, 324 patients in the Permanente Hospitals (Oakland, Calif.) received radiation to the nasopharynx—either gamma or roentgen rays—for hearing loss. The study reported here covers 97 of these who were old enough for audiometric testing, the age range being four to twenty-one years. These patients received five weekly applications of roentgen rays, 108 r each, for a total of 540 r to left and right eustachian tube areas, through 5 × 5-cm. portals (200 kv.p.; 20 ma.; 50 cm. distance; 0.5 mm. Cu and 1.0 mm. Al filtration). Surgical removal of lymphoid tissue from the nasopharynx preceded irradiation.

Good to excellent improvement in hearing was obtained in 47 of the 97 patients; partial improvement in 33; no improvement in 17. Of these last, 2 had biologic deafness and 1 psychogenic deafness; 2 gave a history of meningitis, 1 of encephalitis, and 1 of cerebral concussion. In 17 cases clinical allergy was present. These patients usually showed fluctuating levels of deafness. Nine of the group improved, 5 showed partial improvement, and in 3 there was no change.

In analyzing the series according to type of hearing loss, it was found that of 62 with a "flat" type of loss, all but 5 improved. Of 12 with high level "sharp" loss, only 2 improved. Of a mixed group of 19 patients with both high and low tonal loss, all but 2 showed improvement in the low levels, while upper level improvement was obtained in only 3.

One table. BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

The Flattening of Wedge Isodose Curves in the Direction Perpendicular to the Wedge. L. A. W. Kemp and R. Oliver. Brit. J. Radiol. **25:** 502–504. September 1952.

The usefulness of wedge filters in x-ray therapy is well established (see, for example, Ellis et al. J. Faculty Radiologists **1:** 231, 1950. Abst. in Radiology **56:** 482, 1951). The present report describes an improvement in technic.

By introducing a filter thicker in the center and gradually thinning toward the edge, it is possible to flatten the shape of the isodose curve so that a practically even dose of radiation may be delivered across the central portion of the beam. According to the diagrams presented, this is done without decreasing the dose along the central ray, but by depressing the limbs laterally.

Four illustrations. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

RADIOISOTOPES

A 10-Curie Co^{60} Telegamma Unit (Preliminary Report). Kurt Lidén. Acta radiol. **38:** 139–142, August 1952.

The telegamma unit described in this communication is in use at King Gustav V's Jubilee Clinic at Lund, Sweden.

Two large quantities of cobalt, each containing 8 cylindrical 6 × 6 mm. pieces with an activity of 600 mc., were transferred from the concrete drums in which they arrived to a lead- and iron-shielded box situated just below the telegamma apparatus. From this position, the Co^{60} sources were mounted in small aluminum containers. The activity of each source was measured before loading the container of the telegamma apparatus.

The intensity distribution of the new unit was measured in a 30 × 30 × 25-cm. water phantom. A scintillation detector, using a 3 × 3 × 3-mm. terphenyl crystal, was employed. The tube current was continuously registered on a 6 mv. Speedomax recorder, while the remote-controlled motor-driven detector moved with constant velocity along equidistant lines parallel with the central axis of the beam. Both the detector and the ion-chamber were calibrated with radium sources.

The focal skin distance of the nozzle now used is 6.5 cm. and the area of the circular field is 28 sq. cm. The surface dosage rate in December of 1951 was 39.3 r/hour and the Co^{60} activity was 8.9 curies.

The percentage depth doses along the central axis are illustrated in a graph. It is shown that the ratio of similar Co^{60} and radium units calculated for 6.5 cm. focal skin distance would be slightly greater than 1.0 at depths of 2.0 and 4.0 cm., identical at 6 cm. depth, and slightly greater than 1.0 at 8, 10 and 12 cm. depth. It would seem that the 4-cm. depth dose for the Co^{60} unit is now 40 per cent and at 10 cm. it would appear to be approximately 14 per cent.

The author's experience seems to indicate that for equal skin doses, the skin reactions following Co^{60} irradiation are milder than those after radium irradiation. The assumption is made, however, that the surface dosage rate in air from Co^{60} is 225.5 r/minute at a distance of 1 cm. from 1 curie of the isotope. The object of the work in progress at the time of the writing of this preliminary report was to measure the intensity distribution when the beam head was fitted with a 10-cm. focal skin distance nozzle for circular and and rectangular fields. I. MESCHAN, M.D.
University of Arkansas

The Therapeutic Use of the Radioactive Isotopes in Intracranial Tumors. Loyal Davis and Stanton L. Goldstein. Ann. Surg. **136:** 381–390, September 1952

The study described here was conducted to demonstrate the effect of radioactive colloidal gold (Au^{198}) and chromic phosphate (P^{32}) on the cerebral tissue of 50 healthy adult cats, the object being to determine whether these isotopes might be used in the residua of surgically removed human gliomata without significantly damaging normal tissue. Except for intracystic injections of radioactive colloidal gold into intracranial neoplasm cavities, no one had yet attempted to reach intracranial neoplasms with isotopes.

Small pieces of isotope-soaked Gelfoam or starch sponge were implanted intrathecally in the animals, through a small trephine hole. Controls were implanted with plain Gelfoam, plain starch sponge, and Gelfoam and starch sponge impregnated with nonradioactive colloidal gold and chromic phosphate. Subsequent examinations of the brains, as well as the thyroid, submaxillary gland, cervical lymph nodes, lungs, liver, spleen, kidneys, bone marrow, and gonads were carried out.

In the brain, pathological effects were noted only to a depth of 3 mm. from the implantation site, distant tissues showing no change. Except for the necrosis in early cases, there was no particular difference between the effect of radioactive isotopes and the controls, indicating the high resistance of normal cat brains to radioactive colloidal gold and chromic phosphate even though large amounts of surface isotope radiation was used.

Work is now in progress employing this method of irradiation following surgical removal of gliomas in man.

Au^{198} and P^{32} production, their physical properties, and dosage determinations are discussed.

Six photomicrographs; 2 photographs.

LAWRENCE A. PILLA, M.D
University of Louisville

Localization of Intracranial Lesions by Radioactive Isotopes. William T. Peyton, George E. Moore, Lyle A. French, and Shelley N. Chou. J. Neurosurgery **9**: 432–442, September 1952.

Any intracranial lesion which destroys the blood-brain barrier will take up either radioactive diiodofluorescein or radioactive iodinated human serum albumin. The diiodofluorescein is administered intravenously as I^{131} in amounts of 1.0 to 1.9 microcuries thirty minutes before counting. Radioactive iodinated human serum albumin is injected intravenously in amounts of 5 microcuries per kilogram of body weight. The radioactive albumin remains in the blood stream for a longer period of time than the diiodofluorescein and therefore permits the radioactivity level to remain stable enough for rechecks to be made over periods as long as forty-eight hours without injection of additional radioactive solution. Geiger-Müller counters or scintillation counters can be used to survey symmetrical areas of the head for localization of the tumor.

Cystic and necrotic lesions do not take up the radioactive isotope and therefore may give false localization, with low counts over the area involved. Small lesions do not take up enough of the isotope to give a good differential count, and this is true also of certain types of tumor such as oligodendroglioma. Mid-line and posterior fossa lesions are difficult to localize. The radioactive isotope method of localization does not differentiate between neoplastic and non-neoplastic conditions. High-count foci are found in vascular lesions, and possibly in inflammatory and demyelinizing lesions. Large lesions in the cerebral hemisphere associated with edema are most easily localized. Glioblastoma, meningioma, and metastatic tumors give the best differential counts.

In a series of 57 cases in which the final diagnosis was established, a correct localization was obtained or absence of a focal lesion was established in 75 per cent, when the clinical findings were not taken into consideration in analysis of the counts in the various skull areas. When the clinical data were utilized in the interpretation, correct localization was enhanced to as high as 94 per cent.

Five illustrations; 2 tables.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif

Localization of Intracranial Neoplasms with Radioactive Diiodofluorescein. Robert Dean Woolsey, George E. Thoma, and Robert E. Mack. South. M. J. **45**: 789–792, September 1952.

The authors report their experience with the localization of intracranial tumor by radioactive diiodofluorescein. Diiodofluorescein containing 1.1 millicuries of radioactive iodine is given intravenously. After fifteen minutes, counting by a Geiger counter is begun over any of the standard positions. When there is relative stability of the counting rate, a survey of the cranium with examination of 14 bilateral and 6 mid-line areas is done. Each area is observed until there is a plateau lasting at least two minutes. The sites are alternated from side to side, since comparison of the contralateral sides for each position is important. Areas with counting rate differences are rechecked. Persistence of a counting rate difference is felt to be necessary for diagnosis.

Examinations were done in 114 patients with an accuracy of between 80 and 90 per cent. More errors were made early in the series, accuracy increasing with experience in the procedure. In 67 of the 114 cases, no tumor was demonstrated by diiodofluorescein or any other means. There were 24 correctly localized tumors. Six tumors were missed completely. In 9 cases the test was positive but was unconfirmed at the time of this report. In 2 cases there was indication of tumor location with negative exploration and air studies. One patient with subdural hematoma had a normal record. Two patients with normal tests postoperatively remained without clinical evidence of recurrence. In 1 case there was localization in the left frontal lobe by diiodofluorescein with indefinite localization by ventriculography to both frontal lobes. Craniotomy showed nodular inflammatory disease deep in both frontal lobes. Two tumors were found at operation but localization was imperfect. Four cases are presented in which the diiodofluorescein test was the determining factor in the subsequent treatment.

Convulsive seizures and recent air studies interfere with the test. A patient with encephalitis showed a normal record. The authors do not feel that the type of tumor can be predicted.

MASON WHITMORE, M.D.
Jefferson Medical College

The Use of Radioactive Phosphorus in Mapping Brain Tumors at Operation. T. P. Morley and Geoffrey Jefferson. Brit. M. J. **2**: 575–578 Sept. 13, 1952.

The authors describe their method of using radioactive phosphorus (P^{32}) to identify and map out brain tumors in 37 cases. They use the technic of Selverstone Sweet, and Robinson (Ann. Surg. **130**: 643, 1949. Abst. in Radiology **55**: 472, 1950), employing a modified Geiger-Müller probe counter to detect the beta emissions of P^{32} injected intravenously either twelve hours prior to or at the time burr holes are made. The probe is inserted through the burr holes into the brain tissue. Since the range of the beta particles is only 5 to 8 mm., localization is fairly exact.

This technic has proved useful as a guide to biopsy and for mapping the layout of a subcortical tumor. The biopsy is taken where the count is high. Of 15 biopsies, 14 were successful. The approximate size, limits, and operability of subcortical tumors can be determined. Scanning the bed from which a tumor has been removed is of questionable value.

Causes for error include small deep-lying tumors, the low radioactivity of certain tumors and inflammatory lesions, such as old brain abscesses, which may give a false positive.

The reason for the increased concentration of P^{32} in brain tumors is not known. The isotope is not suitable for treatment.

Four illustrations.

PAUL MASSIK, M.D.
Quincy, Mass.

The Bizarre Behavior of Thyroid Cancer. John A. Duncan, Simeon T. Cantril, and Paul K. Lund. West. J. Surg. **60**: 435–445, September 1952.

This report is based on 31 cases of thyroid carcinoma seen between 1942 and 1951. The cases illustrate the wide variability in behavior of this disease and the difficulties encountered in establishing the diagnosis. One of the cases, for example, is illustrative of a large group of adenomas which are malignant by Graham's criteria (Surg., Gynec. & Obst. **39**: 781, 1924) but are

so completely treated initially that the degree of malignancy remains a question (Case 1). Another case (Case 7) represents a group of adenomas which are benign by microscopic diagnosis but show their malignant nature ultimately by local recurrence or metastasis (so-called benign metastasizing struma). Case 2 illustrates the difficulty in differentiating thyroiditis from cancer. The behavior of thyroid cancer in youth is illustrated by the history of an 8-year-old boy (Case 3) who first had an operation for an encapsulated papillary adenocarcinoma of the left thyroid. Ten years later, in spite of evident metastasis to the lungs and neck, he was symptom-free. A case illustrating the problems of a lateral thyroid tumor is also discussed (Case 4).

X-ray therapy for these cases produced a widely varying response. The primary approach was surgical and often there was no precise information as to the extent of residual cancer. It is considered difficult by the authors to define the effect of x-ray therapy on survival time. The more anaplastic forms respond most effectively to local treatment applied either to the gland or to regional nodes. The favorable results in the papillary adenocarcinomas may reflect the naturally slow course of the disease rather than any modality of treatment.

The effectiveness of I^{131} depends mainly on the avidity, either initial or induced, of the cancer for the iodine. An exception to this was present in Case 8. During isotope therapy a metastatic focus in a rib showed progression even though it had a significant uptake of the tracer dose.

Case 6 is that of a 46-year-old male who had a total thyroidectomy for anaplastic carcinoma. He was maintained on thyroid extract postoperatively, but this was stopped in an attempt to increase the uptake of a metastatic focus in the neck. This failed, however, and there was no improvement in the patient's symptoms until thyroid extract therapy was reinstituted. In the case of benign metastasizing struma (Case 7), a metastasis in the sacrum showed the same histology as a benign adenoma removed three years earlier. Since the uptake over the sacrum was increased, therapeutic doses of I^{131} were given until an estimated dose of 250,000 rep was delivered to the metastasis. Although the defect in the bone showed no change, pain in the sacrum was completely relieved. A nodule in the chest, however, showed no significant uptake of I^{131} and did not change in appearance during therapy.

The authors emphasize that because of the unpredictable behavior of thyroid cancer, evaluation of therapy and prognosis should be done with caution.

Ten illustrations; two charts.

D. D. ROSENFELD, M.D.
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Hyperthyroidism Associated with Diabetes Insipidus: Relief of Both Diseases After Treatment with Radioactive Iodine. Charles W. Rieber and Solomon Silver. Ann. Int. Med. **37**: 379–383, August 1952.

The concurrence of true diabetes insipidus with hyperthyroidism is extremely rare. The beneficial effect on the diabetes insipidus of the treatment of the hyperthyroidism by radioactive iodine is, therefore, of great interest and conducive to speculation.

A 32-year-old male had for many years consumed great quantities of water and passed large quantities of clear urine. During the past two years he had experienced heat intolerance, marked perspiration, palpitation, nervousness, and a weight loss of 20 pounds. His thyroid gland was diffusely enlarged. Blood pressure was 150/60–30 mm. Hg; pulse 120 per minute and of the Corrigan type. Blood sugar was 120 mg. per cent. Roentgenograms of the chest, skull, hands, and feet were normal. The daily output of urine averaged 10 liters, with specific gravity of 1.001 to 1.005. Tests for sugar were negative. One cubic centimeter of pitressin subcutaneously reduced the urine output to 3,400 c.c. in 24 hours. The basal metabolic rate was plus 72 per cent. An oral tracer dose of radioactive iodine was consistent with the diagnosis of hyperthyroidism.

The patient was treated with 5 millicuries of radioactive iodine by mouth. He showed gradual improvement of both the hyperthyroidism and the diabetes insipidus. Ten months later, his general condition was good. His basal metabolic rate was plus 4 and the total 24-hour urine output was 1,900 c.c., with specific gravities between 1.008 and 1.016.

PAUL W. ROMAN, M.D.
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Blood Radioiodine Concentration and Blood Radiation Dosage During I^{131} Therapy for Metastatic Thyroid Carcinoma. S. M. Seidlin, A. Aaron Yalow, and Edward Siegel. J. Clin. Endocrinol. & Metab. **12**: 1197–1204, September 1952.

The authors determine the radiation dosage rate to the blood following the oral administration of I^{131} to 23 patients with metastatic thyroid carcinoma. This was calculated from the I^{131} concentration in the blood, from the disintegration scheme, and the physical half-life of this isotope.

Following a single therapeutic dose, the radiation to the blood has been calculated to be as high as 320 rep and half as high to the whole body, when it is assumed that the blood I^{131} concentration is twice that in all the tissues. This blood radiation level was estimated after the administration of 208 mc. of I^{131}.

When the generally accepted value of 400 r as the median lethal dose of external radiation to man, when delivered within a very short time, is considered, it is noted that it would require about 600 mc. of I^{131} to deliver an equivalent amount of total-body radiation. The LD 50 for radiation from I^{131} would be higher than 400 rep, since the radiation from I^{131} is delivered over a period of about two weeks.

There were no significant complications following a single therapeutic dose in this series except for temporary leukopenia.

The authors also studied the effect of thyroidectomy on radiation delivered to the blood of 5 patients. Their results show that the blood radioiodine concentration is nearly always lower during the absorption period of a thyroidectomizing dose than during the same interval after a therapeutic dose to the same patient following ablation of the thyroid. By contrast, during the phase of release of a thyroidectomizing dose, the blood radioiodine concentration is higher. A rise in the blood radioiodine concentration was observed in euthyroid patients following a thyroidectomizing dose. The phenomenon also occurred following 25 per cent of the therapeutic doses to thyroidectomized patients with functioning thyroid metastases.

ROBERT H. LEAMING, M.D.
Memorial Center, N. Y.

Temporary Hypoparathyroidism Following Radioactive Iodine Treatment for Thyrotoxicosis. William J. Tighe. J. Clin. Endocrinol. & Metab. **12**: 1220–1222, September 1952.

The author reports a case of temporary hypoparathyroidism occurring in a 14-year-old boy two weeks after the administration of 4.0 mc. of I^{131} for the treatment of thyrotoxicosis.

The exact mechanism which induced this complication is not clear. It is assumed that the parathyroid glands involved must have been surrounded by thyroid tissue, since the effective ionization path of beta radiation is limited to a few millimeters. An impaired blood supply to the parathyroid glands as a cause for hypofunction must also be considered. As yet, there have been no published reports of parathyroid injury in man following the administration of I^{131}, even with enormous doses for the treatment of thyroid carcinoma.

ROBERT H. LEAMING, M.D.
Memorial Center, N. Y.

The Effect of Propylthiouracil on the Thyroid Uptake of I^{131} and the Plasma Conversion Ratio in Hyperthyroidism. Alvin L. Schultz and Wyman E. Jacobson. J. Clin. Endocrinol. & Metab. **12**: 1205–1214, September 1952.

This article is based on a study of 9 hyperthyroid patients in whom the plasma I^{131} conversion ratios were studied before, during, and shortly after treatment with propylthiouracil. The diagnosis of hyperthyroidism was based on clinical and laboratory findings, including the thyroid uptake of I^{131}. None of the patients had received treatment for hyperthyroidism prior to this study. The thyroid uptake of I^{131} was determined before treatment in each patient and this served as a control. Each patient then received 300 mg. of propylthiouracil daily for fourteen to sixty days. Repeated thyroid uptake measurements were taken during this period. Treatment with propylthiouracil was then discontinued, and two to nine days later the thyroid uptake studies were repeated. During the control period, the mean maximum uptake of I^{131} was 74 per cent. During the administration of propylthiouracil, the mean was 38 per cent, and after discontinuing the propylthiouracil this figure had returned in six days to the control level of 74 per cent.

It was shown that, although the hyperthyroid patient is made clinically euthyroid with propylthiouracil, the rate constant for the thyroid uptake curve is unaltered and remains at the hyperthyroid level. Therefore, while the quantity of I^{131} accumulated by the thyroid gland is reduced by this antithyroid drug, the rate at which it is accumulated is unchanged. The data compiled by the authors support the concept that propylthiouracil acts primarily by blocking hormone synthesis by the thyroid gland.

One graph; 3 tables.

ROBERT H. LEAMING, M.D.
Memorial Center, N. Y.

Treatment of Carcinoma of the Prostate by Interstitial Radiation with Radio-active Gold (Au^{198}): A Preliminary Report. R. H. Flocks, H. D. Kerr, H. B. Elkins and D. Culp. J. Urol. **68**: 510–522, August 1952.

Patients with carcinoma of the prostate may be divided into three groups. In the first group, comprising 5 to 10 per cent of the total, the lesion is completely confined to the prostate and radical prostatectomy is the treatment of choice. In the second group, which represents 55 per cent of the total, the neoplasm has spread beyond the confines of the prostate and there is usually extension into the periprostatic, perivesical, and perivesicular tissues. Most cases in this group are treated by transurethral resection to relieve obstruction and by hormonal therapy (orchiectomy, estrogen) for palliation. Patients in the third group (30 to 65 per cent of all cases) have local lesions similar to those in Group 2, but in addition have distant metastases. The therapy for these patients has been similar to that in Group 2, with roentgen irradiation of the painful bony lesions.

Irradiation with radium and roentgen rays has been used in Group 2, but severe bowel and bladder irritation and ulcerations have made adequate dosage impossible. The authors felt that by utilizing certain of the radioactive isotopes more localized and intensive irradiation could be given.

This report concerns 20 cases treated by interstitial irradiation with Au^{198}. All of these cases belonged in Group 2. The technic of administration of the radioactive gold involved three basic problems: first, the dosage per cubic centimeter of involved tissue; second, adequate distribution within the carcinoma and lymphatics; and third, protection against radiation hazards.

The dose varied from 0.3 to 3.5 millicuries per estimated cubic centimeter of involved tissue. The gamma component of the radiation becomes increasingly more important as the size of the mass increases, and this explains the wide range of unit dosage per cubic centimeter of tumor. An arbitrary maximum total dose of 160 millicuries was established for fear of the results of total-body irradiation and of liver and spleen concentrations. No appreciable uptake was noted in the liver, spleen, or lungs, but counts taken over the pubic area suggested some loss of gold from the prostatic area. Since this was not accounted for by loss in the urine or in the feces, it was believed that some gold entered the circulation and probably was localized in the liver and spleen.

The combined retropubic-suprapubic approach makes it possible to expose the prostate, the lymphatics about the rectum, the regional lymph nodes, and the seminal vesicles and adjacent lymphatics so that visualized or palpable tumor can be thoroughly infiltrated with the radioactive material. The bladder is opened and the material is infiltrated by multiple injections evenly distributed both transvesically and from the outside into the substance of the prostate, the seminal vesicle compartment, and grossly involved lymph nodes. The colloidal gold diluent is composed of 100 c.c. of normal saline, 100 TU of hyaluronidase, and 1 c.c. of 1:1,000 epinephrin. Pathologic study of material removed three weeks after instillation showed thorough infiltration of all tissues but an uneven infiltration in the substance of the prostate itself. This would account for the fact that tumor may be found on the urethral surface of the prostate, while rectal findings show apparent complete disappearance of tumor. It may also indicate that a combination of interstitial irradiation plus transurethral resection of the entire inner portion of the prostate three weeks later may be the treatment of choice.

Certain radiation hazards were anticipated and en-

countered. These concerned: (1) measurement of the concentrated gold solution and its dilution; (2) protection of operating personnel during and after injection; (3) disposal of contaminated equipment, drapes, sponges, and dressing; (4) isolation of the patient and disposal of his excreta. Adequate lead shielding is used during measurement, dilution, and transfer of the isotope to the lead protected syringe. Since the only protection after injection lies in speed and distance, every possible step in the operative procedure is completed before injection is started. Contaminated syringes and other material found to be soiled after careful monitoring are stored for three weeks until their activity is at a safe level. The urine collected during the first twenty-four hours is stored until the radioactivity dies down.

Early results have been promising. Except in 3 cases, no hardness suggesting tumor could be found on rectal examination after the third week. With one exception, biopsy at the end of three weeks showed tumor still present, but there was extensive necrosis and fibrosis throughout. One serious complication was rectal ulceration. In another patient mild leukopenia developed but recovery was prompt.

The authors present an "addenda report" on an additional 36 cases with similar results except for more severe rectal complications. In 6 of the original 20 cases reported (now six months or more postoperative) rectal complications had developed. The authors state that control of the neoplasm had been achieved thus far as determined by rectal examinations.

Thirteen illustrations; 1 table.

WILLIAM J. GRIPPE, M.D.
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Study of Revascularization of Blood Vessel Grafts by Means of Radioactive Phosphorus. Clifford L. Kiehn, Jerrol Benson, Donald M. Glover, and Marvin Berg. Arch. Surg. **65**: 477–486, September 1952.

Homogenous and autogenous grafts of arteries and veins have been used successfully to bridge arterial defects, autogenous grafts having been somewhat more successful than the homogenous type. The usual criteria of survival of vascular grafts are: (1) effective function of the graft in restoring continuity of the recipient vessel and (2) histologic evidence of revascularization. In order to apply some more objective method, the uptake of radioactive phosphorus has been measured as a means of studying the revascularization.

Sections of the carotid artery of dogs were removed and immediately replaced in the same animal. The dogs were given 300 microcuries of radioactive phosphorus intravenously, either on the day of the surgery or at intervals of ten and twenty-one days. Grafts were then removed at five-, ten-, and thirty-day intervals and sections were assayed for the detection of the isotope. Radioactive iodine tends to concentrate in areas of intense inflammatory or vascular response. In general the more violent the inflammatory reaction (and the higher the relative count) the poorer the functional result of the graft. The reaction is usually influenced by the relative compatibility of the graft, local infection, operative trauma, and cellular changes in the graft prior to placement.

The presence of P^{32} in the grafts can be accounted for in three ways: (1) by physical adsorption because of the direct contact of the blood containing the P^{32}; (2) by entrance into the graft through its developing circulation; (3) by diffusion from the tissue fluids. Successful grafts were found to have a 15 per cent higher count than the controls, whereas the thrombosed grafts averaged about 35 per cent higher than the controls. Thus the counts for a satisfactory functioning graft averaged lower than the mean of all grafts, while those showing thrombosis, necrosis, interstitial hemorrhage, and inflammatory reaction averaged much higher than the mean. The relatively high uptake of P^{32} in the latter instances is interpreted as being due to the active proliferative response of the small blood vessels to the intense inflammatory reaction, which in turn caused increased diffusion of the isotope into the tissue spaces and cells of the graft.

Eight photomicrographs; 2 tables.

ALFRED O. MILLER, M.D.
Louisville, Ky.

The Use of Radioactive Iodinated Human Serum Albumin in Evaluating the Peripheral Circulation. Harvey Krieger, John P. Storaasli, William J. MacIntyre, William D. Holden, and Hymer L. Friedell. Ann. Surg. **136**: 357–365, September 1952.

Serum albumin tagged with radioactive iodine is advantageous in the study of blood flow, since it remains within the vascular bed rather than diffusing through the capillary membrane as do the isotopes with small molecular sizes.

The apparatus used in 97 studies in 77 subjects is described. Either lower or upper extremity measurements can be made with the instrument. An excellent mathematical analysis of the graphs produced by plotting time against counts of the scintillation counter is presented. A constant temperature room free from drafts and an adjustment period of twenty minutes are the conditions to be met before measurements are made.

Comparative experimental circulation curves for extremities under standard conditions and after the production of changes in blood flow by heating, cooling, arterial obstruction, venous obstruction, and posterior tibial nerve block are presented and discussed.

The method was applied to 40 patients with peripheral vascular diseases, with respect to circulatory impairment, selection of patients for surgery, and the results of therapy. The curves are, in general, as might be expected, but the authors' aim is to place the examination on a quantitative basis, that they may be better able to predict the possible benefits of surgery.

Eleven graphs; 1 drawing.

LAWRENCE A. PILLA, M.D.
University of Louisville

Pharmacological Studies of Radiogermanium (Ge^{71}). H. C. Dudley and E. J. Wallace. Arch. Indust. Hyg. & Occup. Med. **6**: 263–270, September 1952.

The authors present a method by which the germanium in tissues and excreta may be determined by radiochemical counting of radiogermanium (Ge^{71}).

Studies of the distribution and excretion of radiogermanium (Ge^{71}) oxide in the rabbit and the dog indicated that this compound is rapidly eliminated, chiefly by way of the urine. No selective tissue localization occurred.

Studies of both stable and radioactive (Ge^{71}) particulate germanium preparations indicated that the organism can easily dissolve finely divided elemental

germanium and rapidly eliminate it, probably as the oxide.

Germanium oxide appears to be pharmacologically inactive. Because of the low energy (9 kv.) of the radioactive form, Ge^{71}, the biological effectiveness of this isotope is not significant.

RADIATION EFFECTS

Third Generation Follow-up in Woman Receiving Pelvic Irradiation. I. C. Rubin. J.A.M.A. **150:** 207–209, Sept. 20, 1952.

The author has previously reported cases of amenorrhea relieved by low-dosage or "stimulating" x-radiation. In further support of this technic for resistant cases of amenorrhea or oligomenorrhea, associated with sterility, a case is reported with follow-up to the third generation.

The patient, at the age of 32, consulted the author with a history of delayed menstruation since the menarche at thirteen years. She had had fourteen years of childless marriage, during twelve years of which she received various medical treatments for sterility and oligomenorrhea. One-tenth of a skin erythema dose of radiation was given and repeated ten days later. A single menstrual period ensued in four days and was followed by pregnancy. Gestation progressed normally, and a normal male infant was delivered by cesarean section.

The boy's testicles descended into the scrotum at the age of thirteen. Studies of his semen at the time of contemplated marriage, at twenty-five years, showed an average number of normal spermatozoa. His child, grandson of the patient who had received the ovarian stimulation doses of x-ray, was delivered almost twenty-eight years after that treatment was administered. Two-year follow-up on this infant revealed a normal healthy child.

The classic experiments with irradiation of *Drosophila* eggs is discussed. The author points out important biological and constitutional differences which make it unreliable to apply results obtained in such experiments to the human being.

ALLIE WOOLFOLK, M.D.
Pittsburgh, Penna.

EDITOR'S NOTE: Publication of Rubin's paper was followed by a protest in the Correspondence columns of the *J.A.M.A.* (Dec. 20, 1952) by W. L. Russell of the Oak Ridge National Laboratory. Russell criticized Rubin's conclusions on the ground of inadequate material and pointed out the latter's failure to make any mention of the extensive work which has been done on x-ray-induced mutations in mammals, which is cause for greater caution in the use of irradiation in man than is indicated by the *Drosophila* experiments to which reference was made.

In the same issue of the *J.A.M.A.* there appear letters from Shields Warren and Samuel Hicks, Ira I. Kaplan, and R. R. Newell. Warren and Hicks also believe that Rubin's conclusions are based on insufficient material. They say: "Although Dr. Rubin's observations are a valuable contribution, one cannot scientifically accept three single cases as excluding radiation effects on human genes. In animal experiments, large numbers of animals must be used to detect genetic changes after irradiation because of the very nature of genetic characteristics. Often genetic changes caused by irradiation do not appear for several generations, and like normal genetic characteristics, do not appear in all individuals."

Newell also questions the implications of the report. He writes "There is a good chance that the apprehensions of the geneticists are well founded. It could be that every irradiation of ovary or testicle that is followed by the birth of viable offspring has a chance to add to the pool of undesirable genetic factors that the race is carrying."

Kaplan, on the other hand, has seen several cases which he believes support the view of Rubin and others that low-dose x-ray irradiation to the ovaries and pituitary as used for the treatment of female sterility produces no harmful effects in human reproduction.

Transverse Band Pigmentation of Fingernails After X-ray Therapy. Richard L. Sutton, Jr. J.A.M.A. **150:** 210–211, Sept. 20, 1952.

A case is reported of a 47-year-old Negress who showed transverse melanotic bands on the fingernails following 150 r superficial roentgen irradiation for dermatitis of the hands. The bands grew out with the nails and disappeared.

The author could find in the literature no mention of the presence or absence of melanophores in or under the epithelium of the nail matrix or nail root, though they must have been present in his patient. Only one other case in which transverse bands of pigmentation on the nails following irradiation has come to the author's notice (Pardo-Castello: Diseases of the Nails, Springfield, Ill., Charles C Thomas, 2d ed., 1941).

One photograph. ALLIE WOOLFOLK, M.D.
Pittsburgh, Penna.

Incidence of Leukemia in Survivors of the Atomic Bomb in Hiroshima and Nagasaki, Japan. Jarrett H. Folley, Wayne Borges, and Takuso Yamawaki. Am. J. Med. **13:** 311–321, September 1952.

Data are presented on the incidence of leukemia and deaths from leukemia in the survivors of the bombing in Hiroshima and Nagasaki during the years 1948, 1949, and 1950. The incidence and the death rate are compared in the exposed and non-exposed populations of the two cities and also within the exposed population by distance from the hypocenter.

A total of 90 cases of leukemia were investigated; 6 of this number were considered questionable and were eliminated. In 47 of the cases there was a history of exposure to the atomic bomb.

An increase in the incidence of leukemia was found in the total exposed populations compared with the total non-exposed populations of the two cities. A highly significant increased incidence of leukemia was encountered in individuals exposed to radiation at distances of less than 2,000 meters as compared with those exposed beyond 2,000 meters. Leukemia in the cases exposed both under 2,000 meters and over 2,000 meters was most frequent in the early and intermediate age groups. Acute leukemia and myelocytic leukemia predominated irrespective of the individual's distance

from the hypocenter at the time of the bomb explosion. Chronic lymphatic leukemia was observed in only a single case.

Six charts; 6 tables.

Scars Remaining in Atom Bomb Survivors. A Four Year Follow-up Study. Warner Wells and Neal Tuskifuji. Surg., Gynec. & Obst. **95**: 129–141, August 1952.

The authors re-examined 63 of 90 patients seen by Block and Tsuzuki in 1946 and 1947 (Am. J. Surg. **75**: 417, 1948) in a study of burn scars following an atom bomb explosion. These patients are divided into two groups, namely, those with and those without symptoms of radiation illness. Fifty-seven of the patients improved; one patient was unimproved and 5 patients were worse. In these latter patients healing occurred, but severe contractures developed, usually in tension areas such as the shoulder, knee, and elbow.

Several important observations were made: (1) There was no significant difference in recovery between the treated and untreated patient. (2) Those patients who had symptoms of radiation illness showed as good healing as those who had no such symptoms. (3) Skin grafts took equally well in the two groups. (4) No cutaneous radiation injuries were noted in these patients. (5) No unusual pigmentation was seen.

The opinion of the present authors and of those who saw the patients in 1946–47 is that the survivors of atom bomb explosions would have similar problems and clinical course if exposed to severe burns and injuries caused by some other agent. The high incidence of keloid formation was due to inadequate treatment, poor nutrition, and the high incidence of infection.

The authors also state that definitive treatment, even at this late date, would be of benefit to these patients.

Thirty-eight photographs.

STEPHEN P. SEDLAK, M.D.
University of Pennsylvania

Protection Afforded by Clothing Against Radiation Hazards. F. R. Holden and A. F. Owings. Arch. Ind. Hyg. & Occup. Med. **6**: 67–73, July 1952.

Clothing affords protection against ultraviolet and infrared radiation; it partially protects the skin from β-radiation and completely protects against α-radiation. The controlled use of clothing not only lessens body contamination and minimizes the hazards of ingestion and inhalation but also helps to prevent the spread of radiocontaminants from "hot" areas to clean ones. Experience at Operation Crossroads demonstrated that the gross contamination by radioactive substances of shoes, gloves, etc., was important. There have been numerous instances in which such substances have been carried on shoes to previously clean areas. Proper use of protective clothing can eliminate the spreading of radioisotopes by human carriers (the atomic-age counterpart of Typhoid Mary).

Clothing should preferably be light weight, nonporous, washable or expendable, and should provide complete body coverage. Leakage at wrists and ankles should be avoided, and at the neck a tight connection should be made to the respiratory protector. Light-colored clothing reflects infrared radiation and thereby minimizes skin burns.

Three tables.

Radiation Reactions in Parabiotic Rats. Joshua L. Edwards and Sheldon C. Sommers. J. Lab. & Clin. Med. **40**: 342–354, September 1952.

A study was made of morphologic tissue changes and leukocyte counts after ionizing radiation, using parabiotic rats. One member was protected from x-rays by a lead shield, and the other member given a single dose of 400, 800, 1,200, or 1,600 r total-body x-radiation. Vascular connections were proved by the use of P^{32}-labeled erythrocytes and T-1824 dye. Forty-eight normal parabiotic pairs and 74 parabiotic pairs of which one animal was completely adrenalectomized were irradiated and autopsied.

No pathologic evidence of radiation to the protected rats was found, such as might be mediated by circulating substances. Increased resistance of parabionts to irradiation of one member was indicated by less marked leukopenia than in irradiated single rats, and the protected rat's leukocytes appeared to bolster the irradiated partner.

Intestinal, lymphoid, and hematopoietic tissues of the protected partners often showed brief periods of hyperplasia following irradiation. This was more frequently observed in the hemiadrenalectomized parabionts. Ovarian granulosa cells and testicular spermatocytes also sometimes became hyperplastic in protected rats, without relation to adrenalectomy. No differences in radiation reactions were observed ascribable to adrenalectomy. Ionizing radiation damage appears to have in common with the "alarm reaction" an inhibition of protein resynthesis following increased tissue break-down.

Ten figures; 4 tables.

Therapy of the X-Irradiation Syndrome with Terramycin. M. P. Coulter, F. W. Furth, and J. W. Howland. Am. J. Path. **28**: 875–881, September–October 1952.

In previous papers the authors presented evidence to indicate the increased susceptibility of the x-irradiated animal to bacterial infections. This is, in part, related to the diminished antigen-antibody response, leukopenia, and destruction of lymphatic tissue following irradiation. Investigation (Am. J. Path. **28**: 25, 171, 1952. Abst. in Radiology **59**: 803, 804, 1952) showed a reduction of morbidity and mortality in dogs given Aureomycin after the administration of a large dose of whole-body irradiation. In view of this, it was thought that Terramycin, a non-toxic antibiotic with a wide bacterial spectrum, would be useful in the prophylaxis of a variety of infections which may occur during the acute radiation syndrome.

Twenty-seven dogs, in pairs, were given 450 r whole-body irradiation (250 kv., 15 ma., planoconvex aluminum filter with 0.5 mm. Cu, target-skin distance 40 inches, rate 7.15 r per minute). Immediately following irradiation, 14 dogs (1 from each pair) received one 250-mg. capsule of Terramycin orally, and this medication was continued every six hours, day and night, for twenty-eight days (100 mg. per kg. per twenty-four hours). The other dogs were untreated.

No significant difference in morbidity or bleeding tendencies was noted between the two groups. The thirty-day mortality for the control group was 92 per cent and for the treated dogs 50 per cent. Treated animals showed no delay in onset of symptoms such as was previously noted in animals treated with Aureomycin. Bacteriologic studies revealed no apparent

difference in the incidence of positive blood cultures in animals treated with Terramycin and the controls. Thirty per cent of the organisms recovered from control animals were resistant to Terramycin; 69 per cent of the organisms from the Terramycin-treated dogs were resistant.

The probable mode of action of Terramycin in reducing mortality has not yet been established.

One graph; 2 tables.

Effect of Bioflavonoids on Radiosensitivity of Transplanted Tumors. Effect on Tolerance to Contact Radiation. Boris Sokoloff, Walter H. Eddy, and George Cone. Arch. Path. **54:** 197–203, August 1952.

A flavonoid compound was given in a total dose of 280 mg. per 100 gm. weight to rats bearing sarcoma 39 or Crocker carcinoma, averaging 17 to 20 mm. in diameter. The animals were then submitted to a single dose of 6,000, 10,000, 12,000, or 15,000 r contact radiation. A Chaoul contact apparatus was employed, with the following factors: 60 kv., a 12-mm. Cu filter, and a 3-cm. distance from the target to the center of the tumor; field 2 cm. in diameter; 450 r per minute. In this experiment the flavonoid compound did not decrease the radiosensitivity of the cancer tissue.

In a second experiment the flavonoid compound was administered in a total dose of 280 mg./100 gm. weight to rats bearing sarcoma 39 or Crocker carcinoma after they had been exposed to a single dose of 15,000 r contact radiation, and was found to exert only slight, if any, protective action against radiation injury. The mortality rate for this group of rats was 66 per cent against 82 per cent of a control group of irradiated rats.

When administered in a total dose of 280 mg./100 gm. wt. to rats bearing sarcoma 39 or Crocker carcinoma *before* they were exposed to a single dose of 15,000 r contact radiation, the flavonoid compound gave considerable protection against radiation injury. The mortality rate for this group of rats was 42 per cent against 86 per cent of the control group of irradiated rats.

When the flavonoid compound was given in a total dose of 280 mg./100 gm. wt. to rats bearing sarcoma 39 or Crocker carcinoma for seven days *prior to* and twenty-one days *after* they were exposed to a single dose of 15,000 r contact radiation it brought down the mortality rate to 28 per cent against 74 per cent for the controls.

The possible relation between the biological activity of flavonoids and the stress reactions induced by radiation is discussed.

One chart; 6 tables.

The Protective Effect of Shielded Ectopic Bone Marrow Against Total Body X-Radiation. J. B. Storer, C. C. Lushbaugh, and J. E. Furchner. J. Lab. & Clin. Med. **40:** 355–366, September 1952.

Lead shielding of small amounts of ectopic marrow induced in the tails of rats by abdominal implantation increased survival of the animals following exposure to 650 r total-body x-irradiation. Shielding of normal tails containing fatty marrow did not increase survival, indicating that marrow cells *per se* rather than other tissues unavoidably shielded are responsible for increased survival in bone-shielding experiments. Implantation of the shielded normal tail into the abdomen following irradiation did not increase survival of rats because of the slowness with which ectopic marrow develops from fatty reticulum. There was no significant difference in the changes in hemoglobin values, white blood counts, or radioiron uptake of rats irradiated with or without shielding of ectopic marrow. No histologic evidence of increased regeneration of bone marrow or of ectopic hematopoiesis was found in the shielded animals. The fact that survival was increased in the absence of evidence of increased marrow regeneration indicates that, in animals irradiated with shielding of hematopoietic tissue, survival does not depend on a more rapid rate of recovery of the unshielded bone marrow.

One hundred and twenty animals were used for this study.

Two photomicrographs; 3 charts.

Cytological Investigation of Bone Marrow of Mice After Administration of Protective Agents and Subsequent X Radiation. Finn Devik. Brit. J. Radiol. **25:** 481–484, September 1952.

The effects of 200 r whole-body irradiation on mice after administering various protective substances was studied. There was no significant change in chromosome abnormalities after the administration of cysteine, glutathione, thiocholine, thiourea, ascorbic acid, methylene blue, and vitamin B_1.

Mice irradiated under conditions of hypoxia showed a significant decrease in chromosome injuries.

The evidence indicates that the effect of cysteine and other substances in protecting against radiation takes place in the cytoplasm rather than in the chromosomes.

One figure; 2 tables. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

The Influence of External Body Radiation on Mortality from Thermal Burns. James W. Brooks, Everett Idris Evans, William T. Ham, Jr., and J. Douglas Reid. Ann. Surg. **136:** 533–544, September 1952.

The authors studied, in the dog, the combined effect of moderate thermal injury and minor external body radiation injury at levels so low that either, if inflicted alone, is relatively non-lethal. This study was prompted by the severe mortality from burns after the atomic attacks on Hiroshima and Nagasaki in the intermediate zones, 4,200 to 7,000 feet from hypocenter, the "zone of combined radiation and thermal injury."

The study was divided into these categories: (*a*) standard 20 per cent contact burn alone; (*b*) 100 r external body radiation alone; (*c*) 20 per cent burn plus 25 r external body radiation; (*d*) 20 per cent burn plus 100 r external body radiation; (*e*) penicillin therapy in animals receiving the combined injuries.

The irradiation was administered at 1,000 kv.p., following the burn in most cases. Various hematologic and bacteriologic studies were carried out. With the addition of 100 r to the 20 per cent burn, the mortality increased from 12 per cent for the burn alone to 75 per cent. With addition of 25 r it increased to 20 per cent.

With the combined injuries an invasion by a more virulent Streptococcus occurred, with a high incidence of fatal septicemia. The authors believe it likely that the radiation depressed defense mechanisms so that the infection could not be localized at the wound surface.

The addition of penicillin therapy following the combined injury markedly reduced the mortality rate.

Six figures; 1 table. LAWRENCE A. DAVIS, M.D.
University of Louisville

Intracutaneous Hyaluronidase Action in Normal and Roentgen-Irradiated Rabbits. Histologic Study. Hugh B. Praytor. Arch. Dermat. & Syph. **66:** 506–516, October 1952.

In an earlier investigation of the biological effect of roentgen therapy, the average spread of India ink with hyaluronidase was shown to be 3.9 times greater than that of the India ink controls (Arch. Dermat. & Syph. **63:** 191, 1951. Abst. in Radiology **57:** 926, 1951). It was further demonstrated that this spread was not significantly altered by irradiation prior to the injection of India ink and hyaluronidase.

A study has now been made of the cutaneous histologic features in 6 normal and 18 roentgen-irradiated rabbits following the intracutaneous injection of India ink and hyaluronidase. The irradiated rabbits were divided into three equal groups and irradiated, respectively, with 400, 800, and 1,600 r at a single exposure to the left side. An India ink-hyaluronidase mixture and diluted India ink were injected intracutaneously into each side of all rabbits. The following conclusions were reached:

1. The ink diffusion in the hyaluronidase-India-ink-injected tissue differed from that in the tissue injected with only India ink by a more diffuse distribution of smaller particles of ink.
2. The intracutaneous diffusion of India ink in the irradiated tissue resembled that in the non-irradiated opposite side in each irradiated rabbit.
3. The intracutaneous diffusion of India ink in the irradiated rabbits was similar to that in the non-irradiated control group.
4. The greatest diffusion of India ink occurred in the subcutaneous tissue in all sections.
5. Histologic evidence of irradiation damage was observed in rabbits irradiated on only one side with 1,600 r. The rabbits irradiated with 400 and 800 r did not show histologic evidence of irradiation damage.
6. Histologic evidence indicating that previously administered roentgen irradiation in any way alters the intracutaneous diffusion of a hyaluronidase-India ink mixture could not be demonstrated.
7. The intracutaneous injection of hyaluronidase did not influence the severity of irradiation damage.
8. Intracellular India ink was observed in epithelial cells in areas of hyperplasia.

Six photomicrographs.

Comparative Action of Cortisone, Desoxycorticosterone and Promethazine on the Resistance of Adrenalectomized Animals to X-Rays. B. N. Halpern, A. Cuendet, and J.-P. May. Schweiz. med. Wchnschr. **82:** 1020–1023, Oct. 4, 1952. (In French)

Animals deprived of adrenal function are more sensitive to diverse aggressions. Cortisone seems to play a predominant role in protection against traumatic and toxic factors, while desoxycorticosterone seems less active.

Adrenalectomized animals have also been found to be more sensitive to irradiation. Experiments are cited to show that adrenalectomized white albino rats are three times as sensitive to roentgen rays as normal controls. Experiments also showed a definite protective effect of cortisone and a slightly less protective effect of desoxycorticosterone. The antihistaminic promethazine not only failed to protect the animals but seemed to aggravate the symptoms. These results would indicate that effects of irradiation are not due to endogenous liberation of histamine but are more closely related to the effects of traumatic shock. The adrenocortical hormones, and especially cortisone, play an essential role in the maintenance of tonus of the small vessels in the shock-like phase or cytotoxic phase of irradiation injury. These hormones, especially cortisone, also exert a protective effect which is shown in the infectious phase following about one week after irradiation injury.

Two charts. CHARLES M. NICE, M.D.
University of Minnesota

Effects of High-Dose Roentgen Irradiation on the White Blood Count of Anesthetized Mice and of Mice Treated with Dibenamine. H. Widmann and R. Ludwig. Strahlentherapie **89:** 243–256, 1952. (In German)

A single total-body irradiation of laboratory mice with 500 or 1,000 r provoked characteristic leukocyte changes (rapid drop in lymphocytes and rapid increase in granulocytes) differing but slightly from each other. In mice narcotized with chloral hydrate and morphine and subsequently irradiated, no statistically significant deviations of this reaction occurred. In animals treated with dibenamine, however, the effect was less marked.

Six photomicrographs; 4 graphs.
ULRICH K. HENSCHKE, M.D.
Ohio State University

Animal Studies on the Reaction of the Serum Proteins After Total-Body Irradiation with 500 r and 1,000 r. H. St. Stender and O. Elbert. Strahlentherapie **89:** 275–282, 1952. (In German)

Total-body irradiation with 500 or 1,000 r, in a single exposure, caused a decrease of total protein, a lowered hematocrit reading, and a decrease in total cholesterol and the number of leukocytes in the blood of the rabbit. The electrophoretic examination showed a decline of albumin and a rise of the alpha and beta globulin fractions.

Four graphs indicate the trend of the changes observed. ULRICH K. HENSCHKE, M.D.
Ohio State University